Popular Science

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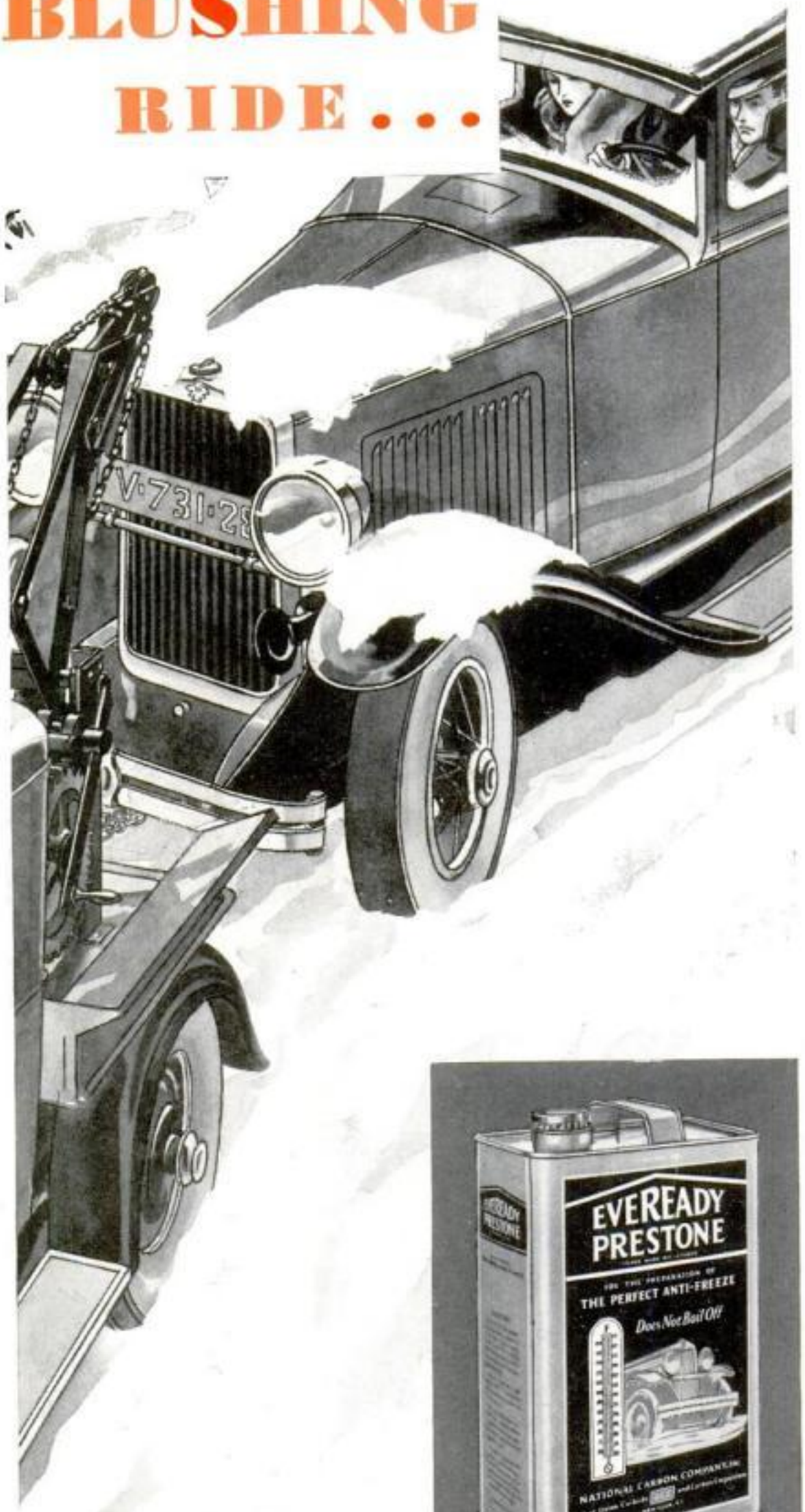

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Popular Science
MONTHLY Founded 1872

381 Fourth Avenue
New York, N. Y.

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December, 1930, Vol. 117, No. 6. **Popular Science Monthly** is published monthly at 381 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Single copy, 25 cents. Nine months' subscription, $2. Yearly subscriptions to United States, its possessions, and Canada, $2.50; foreign countries, $3. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Vice-President and Secretary.

Popular Science Monthly for December, 1930

His Wife Will Never Buy Wildcat Stock

By LEON MEADOW, *Financial Editor*

DOROTHY SUMMERFIELD was at wit's end, and rapidly running out of paper. Couldn't there be a law against banks sending out statements every month? How happy she would be, Dorothy thought, with just her own private balance, and no bank statements to ever worry about—statements that never checked with her balance. If only once it would come out right so Jerry couldn't criticize her lack of business sense.

But it was no use. This month everything was in such a tangle that Dorothy gave it up after an hour or so, and went down to the basement where Jerry, her husband, was fooling with some machinery in his small workshop. "Dear," she began, "you'll have to straighten out my bank book. I just got a statement from the bank—and I'm $34.38 out of the way."

Jerry looked up, his eyes atwinkle with good humor. "What, again—can't you ever figure out a simple thing like that? Say honey what would you do if I weren't here to straighten that out every month?"

"Jerry, please don't talk like that—you know how uneasy it makes me."

"I'm sorry, dear—but talk or no talk, the time's bound to come. I may never have much money to leave—but there will be my insurance. Leaving money is one thing, you know, and leaving it in such a way that it brings you and our children the utmost benefit is quite another thing. Gee, you can't even figure out a bank balance correctly. Wonder what you would do if you found yourself with a few thousand dollars that you had to make cover many, many needs?"

"Look, Jerry,—wouldn't that all be taken care of—wouldn't that all be managed by the insurance company or by the bank or someone, so that I got a regular income out of it each month?" Dorothy said, showing surprise on her face.

Jerry was not quite sure it would be, and his silence indicated his doubt—so his wife continued: "The reason I ask is because Viola Lawson was talking about this business just the other afternoon, and she happened to say that her husband, Timothy, had taken out some kind of insurance or something, I don't quite understand yet—anyway, he pays so much a year, and in case of his death Viola will get a definite sum of money every month for the rest of her life."

"That's something new on me, Dorothy. If what you say is so—and I'm afraid of your usual vagueness on financial matters—the idea certainly sounds wonderful to me—and exactly what would be best for our circumstances. I'll call up Lawson tomorrow and find out more about it."

That's how Jerry Summerfield came to drop in on his insurance adviser, John Fogarty, two days later.

"Sure," Fogarty answered to Jerry's question, "I can fix you up with the same kind of policy Lawson has. But don't look upon it as insurance. Think of it this way:—you pay us a certain amount of money each year, and in the event of your death we guarantee your wife a monthly income for ten years certain and for life."

"Wait a minute, Fogarty, that '10 year' phrase sounds a bit puzzling to me."

"Then, let me explain. First of all the rate you must pay to buy this Life Income Trust Agreement is entirely dependent upon your age and the beneficiary's also. What holds for a man of 50 buying this form of life income for his daughter of 25 could never be the same as a son of 25 buying it for his mother of 50. The rates, you see, are controlled by the estimated mortality of both parties concerned—and therefore their ages are the vital factors, determining the amount of annual payment.

"In the event of your death, let's visualize Mrs. Summerfield and a daughter surviving you. If you carry one of these policies, we guarantee to pay her a monthly income, plus dividends, for life. Or—should she die within less than 10 years after you—we shall continue making these payments to your daughter for the full total of the 10 years, dating from your death. That's what we mean by that 'ten years certain.' It would hardly be a fair risk for us to put a set rate on the payments and then guarantee the income for the life of a 25 year old son or daughter as well as a 50 year old widow."

"Well," Jerry put in, "that makes it a good deal clearer, but let's get down to figures and facts. I'm now 31 and Dorothy is 28 and I'm carrying $5,000 worth of insurance with your company. How do I line up?"

Forgarty consulted his tables for a minute and then said, "If you pay us $11.01 extra a year for every $1,040 worth of insurance you carry, we'll guarantee your beneficiary a monthly income of $10 for ten years certain and for life."

"What am I going to do," interrupted Jerry, "with the $5,000 I already have? Do I have to discontinue that?"

"No, you don't. The $5,000 policy stands—and whether or not you purchase more insurance now—payment on the annuity contract is only dependent upon your present age and the beneficiary's also."

But Jerry now seemed to be losing interest in the argument. His reply showed that his mind had started to run along a different track. "There are a couple of other angles to the situation, Fogarty. The monthly income for life is a splendid idea and I'd rather see Dorothy receive her insurance money that way than leave it in a lump sum to her hazardous discretion,—but I've got a 6% bug in my head. *(Continued on page 5)*

His Wife Will Never Buy Wildcat Stock

(Continued from page 4)

When I start figuring that five, ten or fifteen thousand dollars at 6% will bring in considerably more than you can offer, I begin to grow cold on the whole thing."

Fogarty smiled. "Let me ask you a question, Jerry. So long as your wife gets this monthly income for the rest of her life—or, if she should die in less than ten years after you, your child is guaranteed these monthly payments to the completion of the ten year period, so that in all events the full face value of the policy, plus interest and dividends, will be returned—so long as all this is guaranteed, will you be satisfied?"

"Yes, but that same money at 6%—"

Fogarty interrupted, "Well then, our monthly income plan puts 6% interest, without definite guarantee of either principal or income, right out of the running!"

"How's that?"

"Supposing we hand over $10,400 to a wife upon her husband's death, and she is fortunate enough to invest it safely at 6% —which, by the way, is darned good interest—her income from that is $624 a year or $52 a month. But, if this man had been carrying that much insurance and paying us $110 a year extra—or less than $10 a month—we would guarantee his widow $100 a month for the rest of her life! That's $1,200 a year or twice as much as 6% will do with the same money."

"Where's the hitch?" said Jerry, suddenly, sitting up with a very decided show of interest.

"No hitch at all," the insurance man replied. "The income ceases with the widow's death—or as I said before, should she die in less than ten years after her husband—the income ceases after the 10th full year. In either event we guarantee $12,000 paid over the 10 year period with dividends in addition—on a policy whose face value is $10,400—and beyond that, as in the first instance, we guarantee the widow a $100 monthly income for life."

"You've sold me, Fogarty, on the idea. I've been thinking about increasing my insurance for a few months, now. I believe I can carry another $10,000 safely. After this discussion I'd want to make it the life monthly income type. What would I have to pay—and what would Dorothy get?"

"Let's see—for every $1,040 of insurance, you pay $11.01 extra per year to provide $10 a month life income for your beneficiary. Then, here's the way it works out:

Annual net premium on present $5,000 policy	$ 73.80
Annual net premium on new $10,600 policy	195.64
Annual payments for total annuity @ $11.01 per M	165.15
Total net annual payments	$434.59

"So," Fogarty began, "$434.59 is the total sum of money you pay us for the year, and that includes the premium of $73.50 on your present policy. Tell me Jerry, how are you (Continued on page 6)

His Wife Will Never Buy Wildcat Stock

(Continued from page 5)

paying that—and when?"

"Semi-annually—and, I believe, in February and July."

"Then, that works out perfectly," Fogarty replied. "Because, by taking out this new policy now and paying it semi-annually, you will be able to spread your premium payments for the year over four equally spaced installments."

"How about that extra annual payment of $165.15?" Jerry asked.

"That can be split into quarterly payments also. All you do is add $41.26 to each of your premium payments."

"That 'all you do' phrase is good stuff!" Jerry exclaimed. "Paying $41.26 extra four times a year is no lark. So far you've told me all about the payments I'm going to make each year. Now let's hear something about the returns."

"We'll get there presently, Jerry. But first I want you to notice this," said Fogarty, pointing to the tabulated figures. "I put down $10,600 for the new policy instead of $10,000 as you suggested. That's just to make the total of $15,600 an exact multiple of the unit $1,040—so that the monthly income will also come to an exact figure.

"Which would be?"

$1,800 a year or $150 a month for life."

Jerry Summerfield picked up the paper on Fogarty's desk and studied the figures. Of course, $150 a month would hardly be enough for Dorothy and certainly not enough for her plus children. But it certainly would help form a very healthy foundation for a life income. Increased insurance as his earning power rose, and a few sound bond investments, would do the rest, Jerry reflected. He looked up at Fogarty.

"I pay your company $435 a year—or, in reality, only $165.15 extra—because I intended to take out an additional $10,000 policy anyway. Upon my death, the company retains these $15,600 worth of policies and guarantees to pay my wife $150 a month for her entire life. If she does not survive me for 10 years, the company guarantees to pay this same monthly income to her beneficiary for the full ten year period, dating from my death. Is that right?"

"Exactly, Jerry."

"Well," said Jerry Summerfield, standing up, I'm busy this week, but give me a ring next Monday and we'll make an appointment for the medical examination—in the meantime let's get the papers ready."

Later, as he walked out of the building, a smile lightened his face. Dorothy's tangled bank account was good for something, anyway. It had certainly relieved his anxiety about her financial abilities by leading him indirectly to Fogarty's office. Now, whatever he left her—ten, fifteen or fifty thousand dollars—could be put in safe hands, to bring her a definite monthly income for the rest of her life. No wonder he was smiling and no wonder he was thinking. "Bring on your bank balances, Dorothy!"

(Continued on page 7)

His Wife Will Never Buy Wildcat Stock

(Continued from page 6)

To Help You Get Ahead

THE Booklets listed below will help every family in laying out a financial plan. They will be sent on request.

Your Income and Your Life Insurance is the name of a brief booklet scientifically answering the question "How much life insurance does a man really need?" Provident Mutual Life Insurance Company of Philadelphia, Pennsylvania, will mail a complimentary copy upon request.

The House Behind the Bonds reminds the investor of the importance, not only of studying the investment, but of checking up the banker who offers it. Address: Fidelity Bond & Mortgage Co., 1188 New York Life Building, Chicago, Ill.

How to Get the Things You Want tells how you can use insurance as an active part of your program for getting ahead financially. Phoenix Mutual Life Insurance Company, 328 Elm Street, Hartford, Conn., will send you this booklet on request.

Enjoy Money shows how the regular investment of comparatively small sums under the Investors Syndicate plan, with annual compounding of 5½% interest, builds a permanent income producing estate, a financial reserve for a business, or a fund for university education or foreign travel. Write for this booklet to Investors Syndicate, Investors Syndicate Building, Minneapolis, Minnesota.

How to Retire in Fifteen Years is the story of a safe, sure and definite method of establishing an estate and building an independent income which will support you the rest of your life on the basis of your present living budget. Write for the booklet to Cochran & McCluer Company, 46 North Dearborn St., Chicago, Ill.

See How Easy It Is tells how it is possible to start off with a definite plan for creating an immediate estate leading to future financial security. Get your copy of this booklet by writing to Postal Life Insurance Company, 511 Fifth Avenue, New York City.

Statement of Ownership, Management, Circulation, etc., required by the Act of Congress of August 24, 1912, of Popular Science Monthly, published monthly at New York, N. Y., for October 1, 1930, State of New York, County of New York, ss. Before me, a notary public in and for the State and county aforesaid, personally appeared A. L. Cole, who, having been duly sworn according to law, deposes and says that he is the Vice President of Popular Science Monthly and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 411, Postal Laws and Regulations, printed on the reverse of this form to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are Publisher, Popular Science Publishing Co., Inc., 381 Fourth Avenue, New York, N. Y., Managing Editor, Raymond J. Brown, 381 Fourth Avenue, New York, N. Y., Business Manager, O. B. Capen, 381 Fourth Avenue, New York, N. Y. 2. That the owners are: Popular Science Publishing Company, Inc., 381 Fourth Avenue, New York, N. Y.; Stockholders of Popular Science Publishing Company, Inc., Henry J. Fisher, 230 Park Ave., New York, N. Y.; Oliver B. Capen, 381 Fourth Avenue, New York, N. Y.; Robert Cade Wilson, 683 Springfield Avenue, Summit, N. J.; Ada B. Wilson, 683 Springfield Avenue, Summit, N. J.; A. L. Cole, 381 Fourth Avenue, New York, N. Y.; John Nichols, 381 Fourth Ave., New York, N. Y. 3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of the total amount of bonds, mortgages, or other securities are: none. 4. That the two paragraphs next above giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner, and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) A. L. Cole, Vice President.

Sworn to and subscribed before me this 29th day of September, 1930.

Esther Eyl, Notary Public, Kings County Clerk's No. 57, Registry No. 2065. New York County Clerk's No. 158. Reg. No. 2E117.

(Seal) My Commission expires March 30, 1932.

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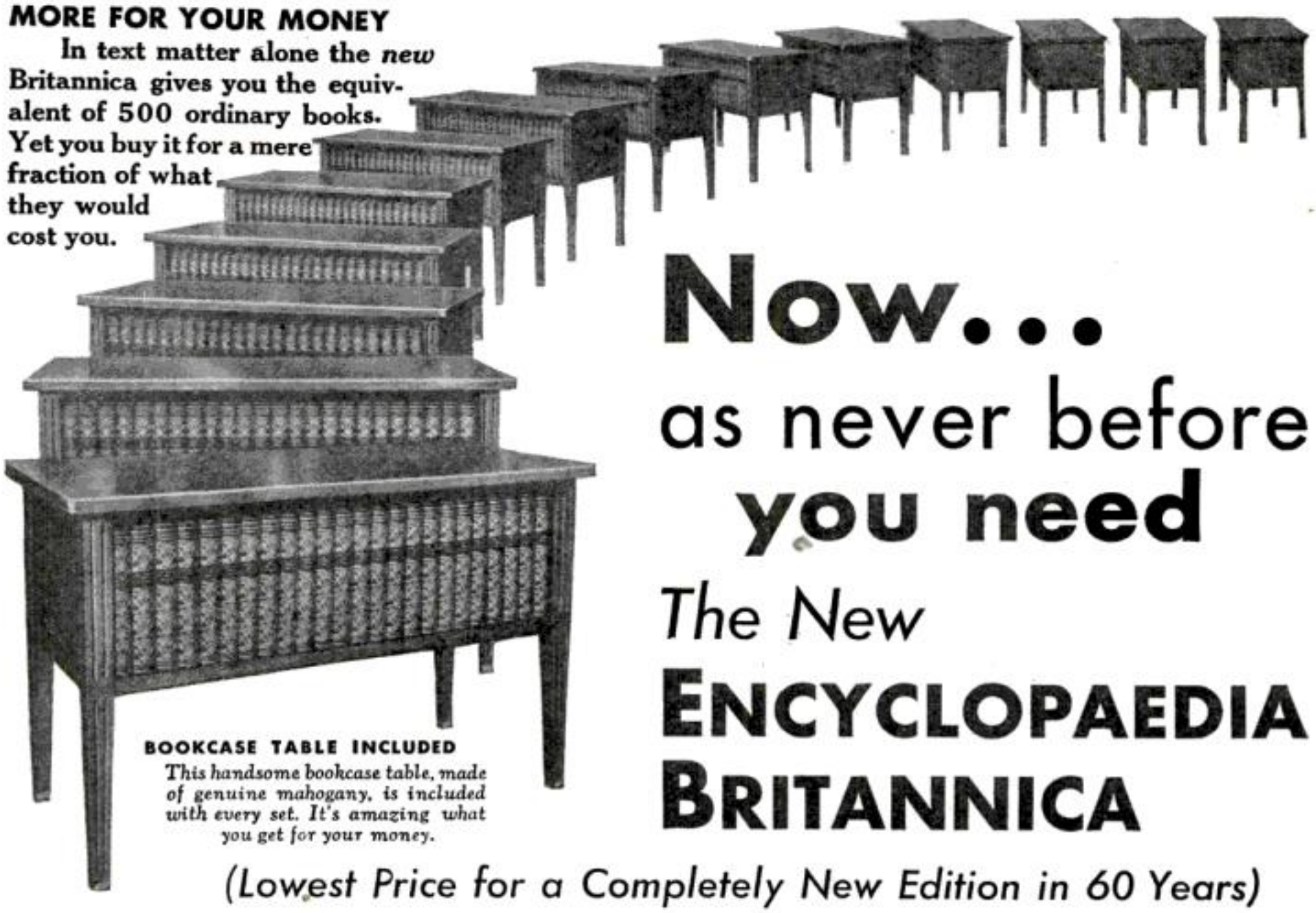

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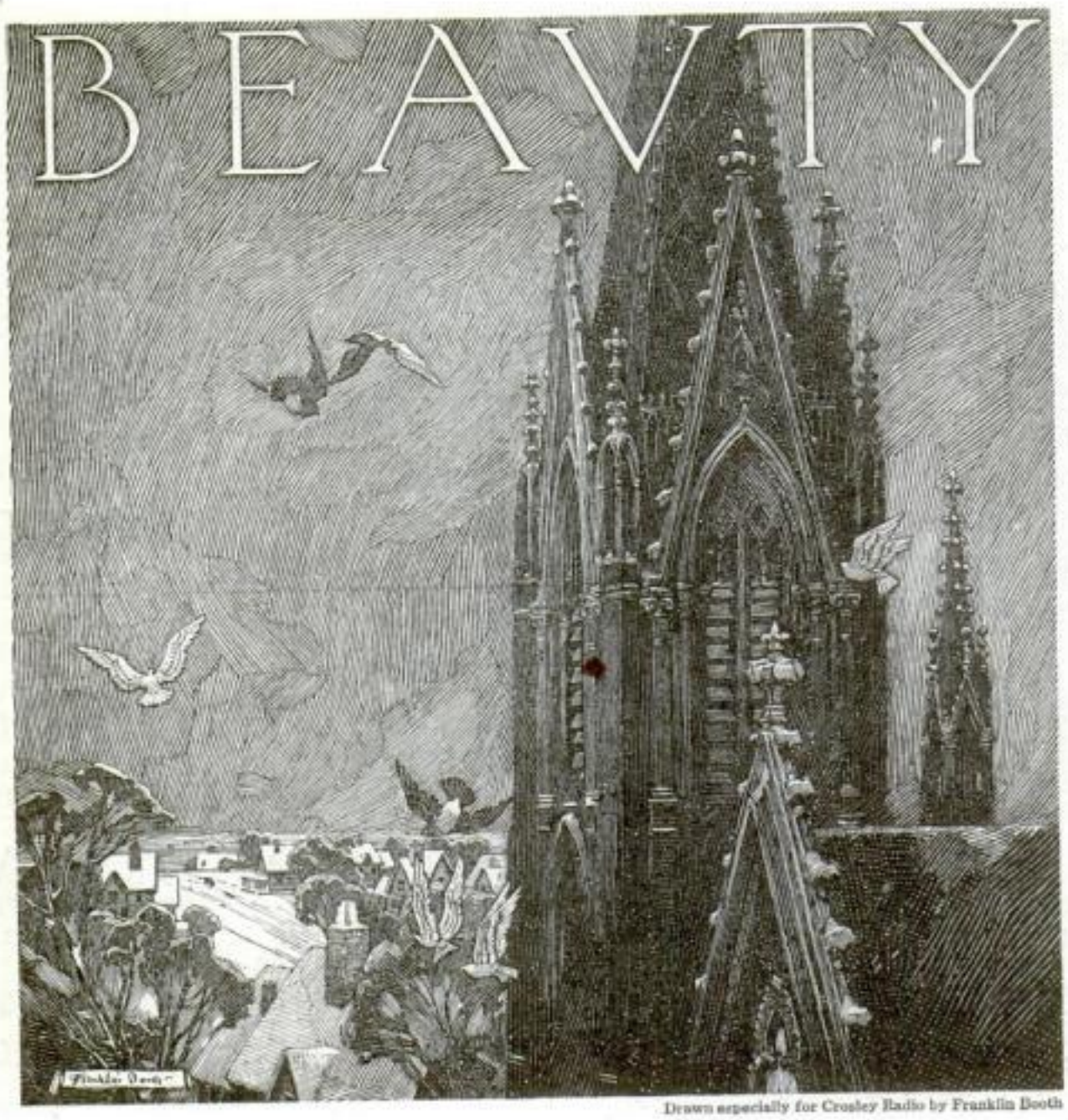

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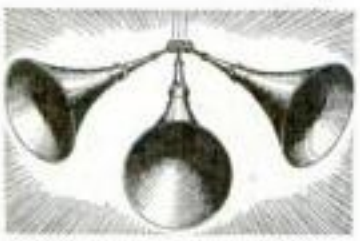
CROSLEY RADIO

Ⓢ This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

"Louder... louder!"

--- a cry of the past—



Straining forward to hear the speaker they were all ears and he was all lungs—but still they couldn't understand him. No wonder "louder please"—and remarks less courteous—were bywords at old time gatherings.

That was before Western Electric showed the world how to amplify and distribute the voice. Today the Western Electric Public Address System brings every word of the speaker to you, even in the last row of the balcony or on the far edge of the largest crowd outdoors.

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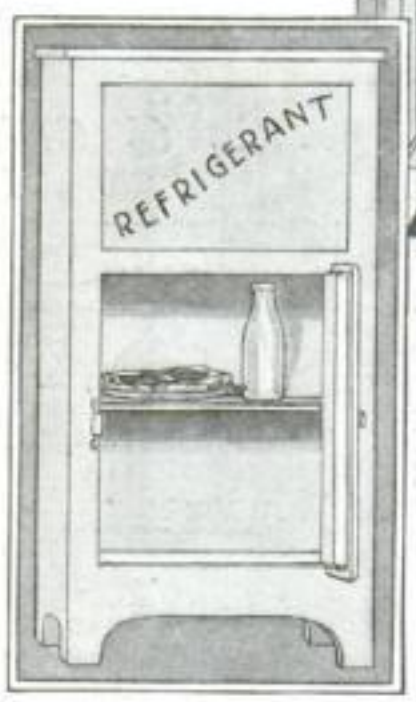
Is Your Food Kept Cold Enough?

It Takes Both a Good Refrigerator and Proper Use of It to Keep Your Food at Safe Temperature

By COLLINS P. BLISS

Director, Popular Science Institute,
Dean, College of Engineering, N. Y. University

The correct placement of **meat** and milk in refrigerator **is** shown here, the position depending on whether refrigerant is located at the top **or** side **of** the receptacle.



Meat and milk always go in the coldest part of a refrigerator, and that depends on the location of the refrigerant that is used.

ABOUT this time of the year, it used to be the custom in a good many homes to tell the iceman to stop coming and to depend on window boxes, cellar "cold rooms," or some other similarly ineffectual means for keeping perishable food. Now, most of us know enough about the dangers of inadequate refrigeration to insist on using either ice or mechanical means to preserve food the year round.

However, a number of things have been found out recently about refrigerators and their use that are not very generally known. For instance, how many people realize that there are different temperatures in different parts of a refrigerator, and that there is a right and a wrong place for various types of food? Owning an efficient refrigerator is not enough; it is also necessary to keep in mind certain facts regarding operation and care. With a refrigerator, the results of improper use are not as apparent as with most other devices, making it advisable to be doubly particular.

One of the first things to make sure of is that the food is stored in the box properly in so far as placement is concerned. Certain principles of refrigeration make it advisable to place various types of foods in special sections of the box, depending on where the refrigerant (whether ice or mechanical cooling unit) is located. In a refrigerator that is cooled from the side, the coldest part is directly under the ice compartment or cooling unit, and the warmest part of such a box is the top. On the other hand, when the box is cooled from above, the coldest part is immediately under the cold air drop, which is the center of the top shelf, and the warmest place is the extreme edge of the bottom shelf. However, in a refrigerator having the cooling arrangement last described, there is not so pronounced a variation in temperature for the different parts of the box as when the cabinet is cooled from the side.

MILK and meat require the lowest temperature for preservation and consequently come in for a favored place in the coldest part of the refrigerator. After that, butter and other delicate foods get the next coolest location, and so on down to eggs and fruit which will keep satisfactorily in the less cool sections of the box. However, no part of a really good refrigerator should go over 52°F. and the coldest part, where meat and milk is kept, should be about 45°F. when room temperature is 75°F. These temperatures are in accordance with recommendations of the Bureau of Home Economics, U. S. Department of Agriculture.

WHEN an iced refrigerator is used, the essential thing is to keep it filled with enough ice. A refrigerator is at its coldest about one hour after the ice compartment is filled; from that point on, the temperature increases until the ice supply is exhausted. Tests in the same box have shown that, when eighty pounds are in the ice chamber, the meat compartment will be at 42°F.; but, when the ice has melted down to twenty pounds, the coldest part of the box will be 47°F. and the warmest part 58°F.

Overloading the food compartment is an error sometimes made. It is not so much the size of the refrigerator as the amount of food stored in it that affects the temperature. It is advisable to make a few thermometer tests, therefore, and see just what temperature a refrigerator will maintain with different loads of food and then store no greater load of foodstuffs than it has the capacity to handle.

In placing dishes or containers in a refrigerator, they should be arranged upon the shelves to permit free air circulation. Any hindrance of air circulation results in stagnant sections of warm air. Likewise, it is a mistake to store food and bottles directly around and on top of the ice block, as is frequently done. Carelessness in opening doors lowers the efficiency of a refrigerator, causing a marked increase in temperature, and the same thing happens when hot foods are inserted.

AS TO mechanical refrigerators, the less tinkering done the better. The unit in such refrigerators should be left entirely alone and, should any trouble develop, the owner will be helping both himself and the manufacturer to secure best results by doing nothing more than he has been instructed to do.

Readers who are interested in keeping their food safely and want full facts regarding various types of refrigerators, method of operation, cost, care, etc., can obtain for twenty-five cents the booklet "Refrigeration for the Home" issued by POPULAR SCIENCE INSTITUTE, 381 Fourth Ave., New York, N. Y.

INSTITUTE BULLETINS

Refrigeration for the Home*
Heating and Ventilating*
Insulation in Building Construction*
List of Approved Tools
List of Approved Radio Sets
List of Approved Oil Burners
Advice on Installing Oil Heat

*Starred bulletins 25 cents

BOYS!!

a college education!

ENROLL IN THE

FISHER BODY CRAFTSMAN'S GUILD

984 awards valued at $50,000
offered for excellence in craftsmanship

How would *you* like a Scholarship to your favorite University or College, *with all expenses paid for four years?* This opportunity is open to you when you enroll in the Fisher Body Craftsman's Guild. And there are no fees or dues of any kind connected with membership.

Like the famous Craft Guilds of olden times, the Fisher Body Craftsman's Guild was founded to honor and advance the art of fine workmanship. But never in the history of the world have boys enjoyed such opportunities for reward and self-advancement as this modern Guild now offers you!

In addition to four University Scholarships of four years each, valued at $5,000 apiece, there are 980 other substantial awards, bringing the combined value to more than $50,000! Included are trips to the world's greatest automobile center, with recognition leading to careers in industry, as well as numerous awards in gold amounting to $16,000.

Awards go to boys building the finest model Napoleonic Coaches

To compete for the awards, each member of the Guild will be required to build a miniature model coach whose design is taken from two world-famous coaches used by Napoleon. Detailed drawings and instructions on how to build it at every step will be supplied by the Guild.

The best coaches will be selected by an honorary Board of Judges, consisting of distinguished University Educators and headed by Daniel C. Beard, National Boy Scout Commissioner. The awards will be equally divided among two groups, one group for boys of 12 to 15 years, inclusive, and the other for boys of 16 to 19 years, inclusive. In this way, every member will have an equal opportunity to share in the valuable awards.

ENROLL NOW, WITH NEAREST GENERAL MOTORS DEALER

If you are between the ages of 12 to 19 years, inclusive, just go to any Dealer for Cadillac-La Salle, Buick, Oldsmobile-Viking, Oakland-Pontiac or Chevrolet cars, and ask him to enroll you in the Guild. There are no fees or dues. In a few days, you will receive your membership certificate, button, and complete drawings of the miniature model Napoleonic coach that you will build.

The door of opportunity is wide open for any boy with the energy and enterprise to enter and take his place in the Fisher Body Craftsman's Guild.

Hurry. See a General Motors Car Dealer today and enroll!

FISHER BODY CRAFTSMAN'S GUILD

Sponsored by FISHER BODY CORPORATION *Division of General Motors*

Our Readers Say

You Helicopter Men Better Listen to This

ABOUT that new Curtiss helicopter you describe. The designers seem to have forgotten all about Newton's third law of motion, which says, "To every action there is always an opposite and equal reaction." It still seems to be in force in most machines but doesn't seem to have been given much thought in this case. What is going to keep the body of this helicopter from turning, as soon as it leaves the ground, instead of the air screw which will have a great air resistance? Of course, it would be O. K. on the ground, as the whole earth would act as a reaction. But in the air there will be a 420-horsepower motor trying just as hard to turn the body backwards as to turn the air screw forwards. Get me? But I hope I am wrong, as I have wanted much to see a practical plane that would rise vertically, and land vertically, as this is the one thing I can think of that would make planes easy to handle and safe for the novice so that soon they would be as common as flivvers. That's why I said I hope I'm wrong. Still I don't see how I can be wrong unless the spin vane is terribly efficient (which of course it couldn't be).—D. A., Rupert, Idaho.

Tells His Experience With Patent Office

I CAN'T help but admire your straight-from-the-shoulder Patent Office articles. You are one hundred percent right. I for one have three patents pending, one of them a year and ten months old, and have only first action as yet. The others are a year and over, and one of them has not even first action. Is this not a disgrace? If a private corporation did this it would be front-page stuff. Why not others? Let those who disagree with you produce their proof that conditions are all right. Thank you for your consideration for others.—New Yorker, New York City.

Ever Hear of Kite Flying Three Months?

IN A recent issue of POPULAR SCIENCE MONTHLY, I noticed that J. T., of Akron, Ohio, wanted to know the world's record for kite flying and said he wanted to set a new record. Although I cannot tell him the exact number of hours in the record, I do know that there are people in Bengal, India, who keep their kites flying for as long as three months. They do this as part of a festival. Generally the kites are big and fastened with stout cord. Some of them are so big that two or three men are needed to hold them from blowing away. If one of them succeeds in keeping his kite clear of the ground, and not touching it, during those three months, he considers himself lucky and will invite his friends in for a good dinner.—S. K. S., West Lafayette, Ind.

Eight Models? Huh, He Has Seventy-Five

IN POPULAR SCIENCE MONTHLY a writer from Australia says that he has eight ship models cluttering up his living room. That may be a lot out there, but back here in the states we have seventy-five models, anywhere from four inches to one foot in length, in our living room. Why doesn't he get a reputation?—J. M. M. and W. T. W., Birmingham, Ala.

All Changed for the Better Now

YOUR new way of printing the cover on POPULAR SCIENCE MONTHLY looks like the binding machine slipped and about half of the cover slid around to the back of the magazine. If you are going to ruin the looks of the cover anyway, why not just take off all of the picture and print a table of contents on the front? I guess the only person who isn't kicking about the new cover is Mr. Paus, as he only has about a third as much work to do. If the readers are going to open the magazine anyhow, then why the lazy man's index? I have a feeling others would also be glad to see a change.—J. D. Mc Ph., Birmingham, Ala.

Civil War Echo Up from Alabama

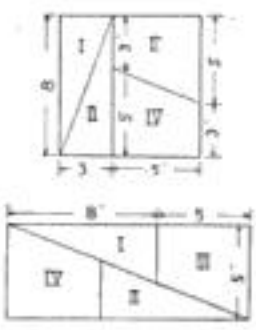
I WAS greatly interested in your articles on the Patent Office and the comments you published on them. I do not know about the disgrace of the Patent Office, though I am sure you printed the truth, but I do know that any Government that will take cotton from widows with helpless children, sell that cotton, and put the money in its treasury and never pay the owners one dime for the cotton, is a disgrace. The Government has never given these victims a hearing in any competent court. But surely a just God will not bless any Government that does such things. There are enough just men in Washington to right these wrongs, but seemingly these just men lack the backbone necessary to see that justice is done.—A. J. H., Mobile, Ala.

Well, Who Does Know What He's Talking About?

I WISH to say that A. L. certainly does know what he is talking about and that L. L. does not know what he's talking about. The less venturesome people are the very ones we wish to win over to aviation. The more venturesome are probably already in it or perfectly willing to get in. My brother and I usually have a fight over POPULAR SCIENCE MONTHLY when it comes. I wish you would run some plans of model steam engines of the high speed trunk type and two cylinder upright marine, some that require real workmanship. These are the kind that will keep us busy for a long time and of which we can be proud when they are finished.—W. C. H., San Luis Obispo, Calif.

Can You Help With This Square?

I HAVE a problem on which I would like your advice: I have a square eight inches by eight inches. This is divided as shown in the diagram and rearranged as shown. In the square the area is sixty-four square inches, and in the rectangle the area is sixty-five. I would like to know where the extra inch comes from. Maybe some of your puzzle fans could help me out, as I'm certain I've no solution. While I'm about it I would like to say that I enjoy your magazine very much.—T. M., Sheboygan, Wis.

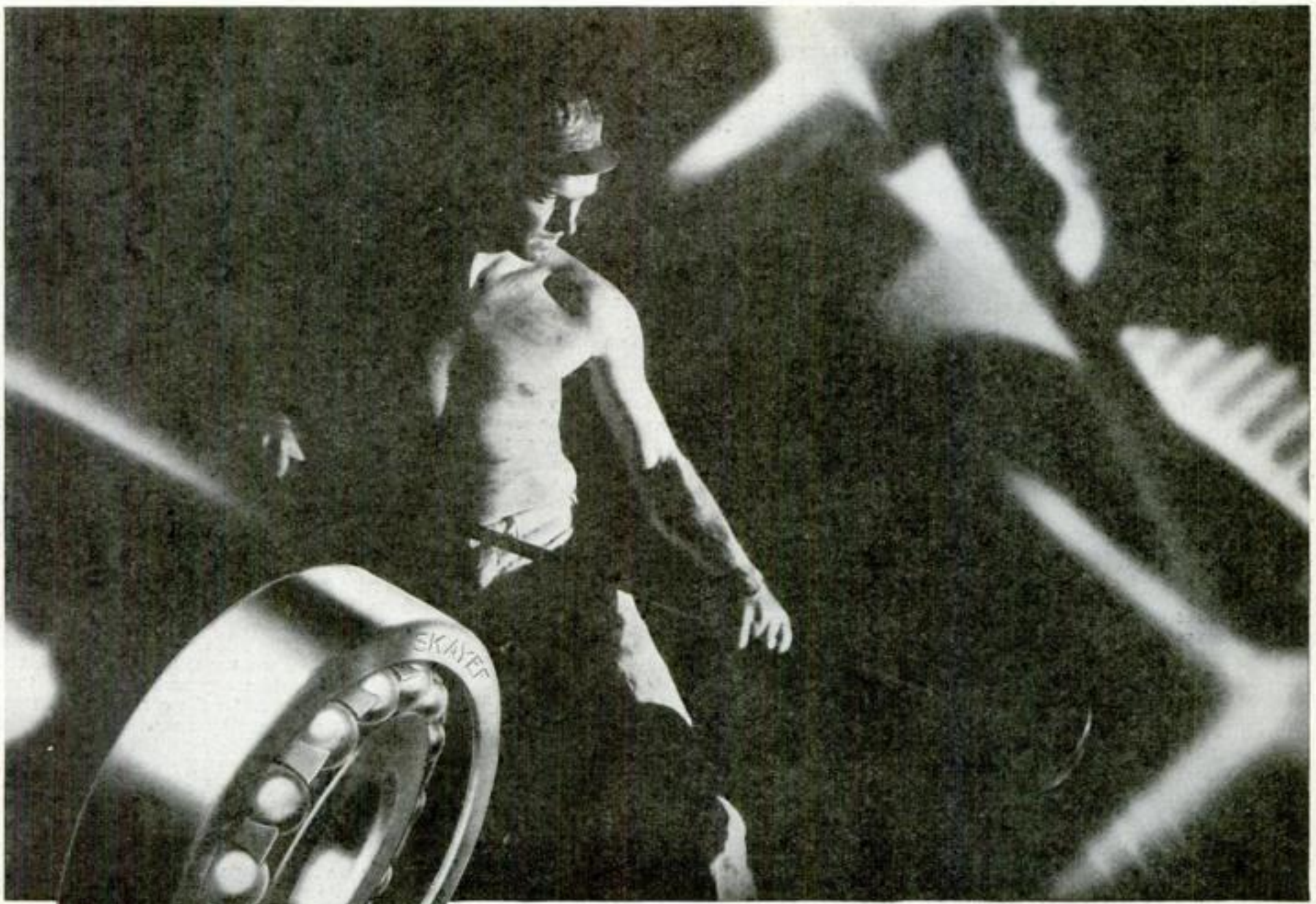


Would You Say E. B. B. Made a Hit?

OF ALL the small and unnecessary forms of criticism I ever heard of, E. B. B. of Portland, Ore., surely has the smallest. Anyone even thinking in such narrow lines should congratulate Nero for his part in burning Rome. I thought POPULAR SCIENCE MONTHLY'S criticism of the Patent Office conditions was rather mild. The open and well founded criticism that you publish is what makes me take my hat off to your magazine above all others.—J. A. E. C., Medina, Ohio.

Here's One for You Inventors to Try Out

THE FOLLOWING suggestion deals with what might be termed a remote possibility, though it may have an even money chance of being a complete success. The possibility of fixing a self-launching device or self-starter onto a glider and making it a complete one-man power unit has not yet seriously engaged the attention of the experts in the field of aviation. If the fuselage of the glider can be built light enough and strong enough to stand a comparatively big strain it might be possible to devise some simple form of elastic motor that would bring the one-man power plane into the realm of practical use. Could not a self-starter operate a small propeller immersed in water and the air screw be foot driven? In theory, of course, the combination of the air screw and small water screw would make unassisted human flight possible. A few strands of elastic and a length of cord are all that would be needed for the self-starter.



PERFORMANCE...

that's it... PERFORMANCE

...in a Bearing it's the only thing that counts

JOT that fact down on the margin of your blue-print now ... file it away in one of the pigeon holes of your mind. Performance is the thing you want when you buy a bearing. Performance, in a bearing, is the only thing that counts.

SKF is a symbol of a world-wide bearing organization that has persistently refused to manufacture down to a price. SKF is the highest priced bearing in the world.

And yet, there flow into SKF Headquarters reports of SKF Bearings that have traveled a million miles in railway journals without showing wear . . . of other SKF Bearings that are part of the mechanical equipment of practically every trans-oceanic flight . . . of others still that serve year after year on thousands of industrial jobs.

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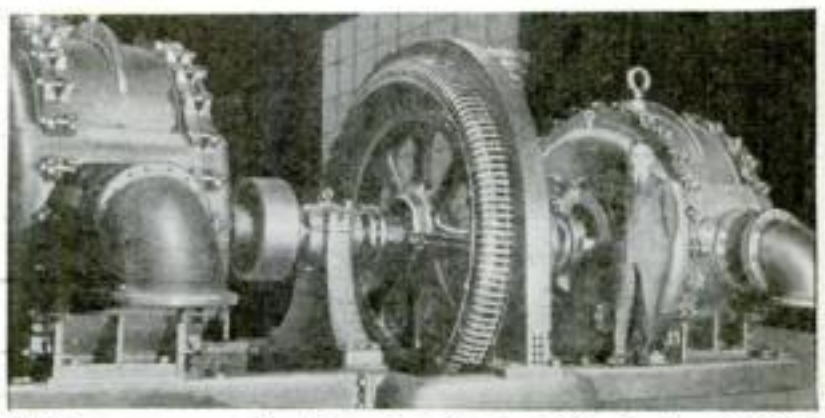


Performance was the thing that inspired the choice of SKF Bearings for these giant pumps, made by the Nash Engineering Company of South Norwalk, Conn. Photograph illustrates the largest vacuum pump installation in the world.

Simple methods of winding up the self-starter could be devised. For my part, I think a machine of this kind fitted with a rocket as a starter would be more successful. What do other readers of this magazine think of this?—H. R., South Shields, England.

Philippine Student Meets Utmost Intention

IT IS my utmost intention to emphasize to you that your POPULAR SCIENCE MONTHLY gives me pleasure upon reading it, not withstanding the fact that I am not a subscriber but merely a reader. Really I am astonished of its articles and illustrations as they give me countless hints and information. I do not praise with the word but with the heart. As I am a student in the High School here, your up-to-the-minute magazine serves me as a guide and I can find no other magazine that will best satisfy me. Sooner or later I think I can secure a subscription to your valuable magazine. Our school has a supply of some magazines of the same kind, the students admired them. But when I presented them your POPULAR SCIENCE MONTHLY, everyone took an eye on it, and from that time your magazine became a craze to each and everyone of us, teachers and students alike. Remember that even here in our native land, thousands of miles away, the POPULAR SCIENCE MONTHLY shall become the most distinguished, alone, in the lines of its kind. Believe me. Wishing you all good in the most respectful way of wishing.—L. P. N., San Fernando, Philippine Islands.

Offers Solution of Television Problem

HAVING read your article on the latest developments in television and realizing the need of keeping the motors of the scanning disks synchronized, I suggest this: Have a speedometer coupled to each motor with rheostats wound on the dials. The positive wire to the motor should be connected to a brush that makes contact with the resistance wire and a wire from the O side of the scale carries the current to the motor. When the current is off, the brush makes contact with the O part of the scale. When the current is applied the motor receives the full current because it does not have to pass through much resistance wire. As the motor gains speed the dial of the speedometer swings around and reduces the current, by making it flow through more wire, slowing the motor. If the speedometers and resistance wire be standardized the motors will be synchronous.—S. C. K., Hodgenville, Ky.

Don't Fight Father; Grab Magazine and Run

ALTHOUGH I am a girl seventeen years old and intensely interested in art, I'm sure no boy gets more enjoyment than I from reading POPULAR SCIENCE MONTHLY. I think the section "Our Readers Say" is one of the best features in the book. Nevertheless, it all interests me, and every month there is a fight between Dad and me over who's going to read it first. I agree with W. F. H. about the cover. I enjoy it, and as far as I'm concerned, the more space devoted to Paus' pictures the better.—L. E. P., Fort Myers, Fla.

Voice on Speeding Comes from Georgia

YOUR article on "Shall Speed Laws Be Limited?" says that in Georgia only heavy vehicles are limited to forty miles an hour. This is erroneous, as the forty-mile limit applies to all cars. Further on you say that railroads operate at sixty miles an hour only because they have skilled operators and safety devices. Here is a factor you seem to have overlooked: An auto weighs between 1,500 and 6,000 pounds. A train weighs between 500 and 2,500 tons. It takes a lot of force to hold 500 tons moving at sixty miles an hour to the rails on the curves. This work is done by the flanges on the wheels. A car, a thousand times lighter, is held on the corners by the adhesive quality of balloon tires. You will admit that a car is under better control when traveling thirty or thirty-five miles than when only fifteen or twenty if it has good brakes. Be a little more liberal with the fellow who has yet to learn from experience. If you want to do motorists a good turn call attention to the buses that run at fifty to seventy miles an hour even where the speed limit for heavy traffic is only thirty miles an hour as it is here in Georgia.—W. J. M., Macon, Ga.

Another One Wants Locomotive Models

I HAVE been a subscriber of your magazine for three and a half years and I haven't found any publication in its class that can beat it. I agree with W. R. of New York—give us some working models of locomotives. —J. V. S., Washington, D. C.

African Nut Puzzle Cries for an Answer

WHILE you are in the mood for puzzles let your readers work this out: Five men go into the wilds of Africa and gather a large pile of nuts and decide to divide them equally among themselves, and then retire. Late at night one man arises and decides to take his share and leave, but when the division is made there is one nut over so he throws it away. A little later another man arises, and not knowing of the former man's division, redivides the pile into five equal parts taking his fifth. But again there is an extra nut which is thrown away. This procedure is continued by each man, each taking one fifth of the remaining pile and each throwing away a nut. The problem is: how many nuts were there originally, and how many remained when all men had left? This is not a trick puzzle, but a mathematical problem with, so far as I know, only one solution.—C. W., Bailey, Colo.

Sounds Good to Us, But Is It True?

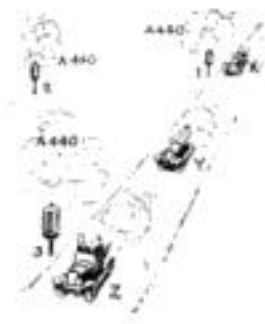
YOUR magazine is the greatest on the market both from a scientific and a human standpoint. It is a value both in entertainment and in dollars and cents.—M. R. Q., Los Angeles, Calif.

Built His Success From Our Plans

I AM a regular reader of POPULAR SCIENCE MONTHLY and was greatly pleased with your boat building articles in April and March issues. My brother and I and two chums have built the boat and named it *Success*. It was our first experience in this line. We built it slightly smaller than the dimensions given, and it will accommodate seven persons easily. With an outboard it will do eight miles an hour with two in it. I should like to see you print plans for a sixteen-foot vee-bow outboard motorboat.—L. J. B., Grand Falls, Newfoundland.

Can One Whistle Sound Full Chord?

NOT many persons notice the sharp drop in pitch of a train whistle when it passes at high speed, but the phenomenon affords some interesting possibilities. For instance, in the sketch we have three whistles 1, 2, and 3, each sounding A440. Whistle 1 and 3 are at the roadside while 2 is some distance back. A car traveling 245 miles an hour arriving at position X will hear the note D above A440 from 1, and on passing 1 the tone from it will drop to D below A440. The tone from 2 will gradually slide from about B above A440 to A when opposite 2 at Y. At the same time, while approaching 3, the tone will be D above. So the car, while between 1 and 3, will actually hear tones an octave apart and 2 will slide from B to G depending on the distance back. By arranging whistles and varying the speed, a full chord could be heard from this one pitch. If one could travel with the speed of sound—well, maybe we had better leave that to Herr Einstein while we slow down for the crossing. Would this make good reading for your magazine? —A. T., Jr., Ashland, Ky.



Just Automatically Got His Magazine

I HAVE been reading POPULAR SCIENCE MONTHLY for five months and we are going to be pals for life. For the first couple of months, my funds were low and I received the unwelcome notice from my mother that I must cancel my order for the next copy. However when I reached the news stand, my memory automatically failed me. But everything is quite all right now, thank you. May I suggest that you publish monthly articles on model yachts and boats? And first start by telling your readers how to build and rig one.—R. H. J., Grays, England.

Plans Spring Runway For Landing Planes

I READ in the POPULAR SCIENCE MONTHLY about Randy Enslow piloting six-ton trimotored planes. He says that a greenhorn, when landing a six-ton ship like that, usually makes a perfect landing at about twenty to forty feet in the air, and then makes a flop, a pancake landing, and wrecks the whole ship. With such expensive airplanes, why not make a runway on springs so it would be impossible for an airmachine to crash? If an airplane made such a flop landing on this spring runway, the runway would give and the airplane would land on it as softly as a rubber ball on a rubber mat. I am making a model one now, and when I get it finished I will send it to POPULAR SCIENCE MONTHLY, to see if it is worth while experimenting with it.—S. M. M., Ignace, Ont., Canada.

In bad weather, attack the germs that cause COLDS and SORE THROAT

Listerine used as a gargle reduces mouth germs 98%

When you gargle with full strength Listerine, the safe antiseptic, you strike a blow at germs that cause colds, sore throat and many other troubles.

For Listerine kills germs by the millions in 15 seconds — the fastest time science has been able to *accurately record.*

Reduces germs 98%

Bacteria on the surface of the mouth and in the saliva are actually reduced 98% by it. Such amazing killing power is shown by exhaustive tests after the methods employed at Johns Hopkins and Yale University. To maintain this reduction at all times frequent gargling is necessary. In view of the above facts, you cannot question the wisdom of using Listerine morning and night as a precaution against mouth and throat infections incident to colds. And as a treatment, more frequently.

Gargle every 2 hours

Colds usually develop when body resistance is lowered by bad weather, over-exposure, chills, fatigue or over-eating. Germs easily make headway. Nature then needs an extra attacking force to keep them under control. That is why physicians urge the gargle every two hours with undiluted Listerine. Every gargle results in the death of millions of disease-producing bacteria.

Twice a day as a precaution

Every 2 hours as a treatment

Safe — healing to tissue

At the first symptom of cold or sore throat, begin using Listerine. Use it full strength to get full germicidal effect. Remember, Listerine is absolutely harmless — non-poisonous, safe and pleasant to use, and actually healing in effect. Lambert Pharmacal Company, St. Louis, Mo., U. S. A.

the safe antiseptic

KILLS 200,000,000 GERMS IN 15 SECONDS

(fastest killing time accurately recorded by science)

THIS IS THE THIRD OF A SERIES OF ADVERTISEMENTS DEALING WITH ULTRA-VIOLET RADIATION IN THE HOME

From GENERAL ELECTRIC *to American Mothers* . . . . .

TO American mothers who are bringing up clear-eyed, stout-hearted, tumbling future presidents, aged from one month to fifteen years, winter with its close confinement, its short, dark days and its complete lack of health-giving sunlight, presents a real problem—a real challenge to motherhood. No matter what other matters may occupy her mind, the chief concern of every mother is in answering this challenge of winter—in fighting off by every means in her power the many menaces of winter—and especially sun-starvation.

Most mothers now know that the sun which shines on a winter day—even the clearest and brightest—contains only two per cent of the vital health-maintaining ultra-violet rays found in summer sunlight. Those highly beneficial rays which tan the skin, build up resistance to disease, promote nutrition, stimulate growth; which are essential in building strong bones and sound teeth and which liberate in young bodies that elusive, life-giving vitamin called Vitamin D—

The Sunshine Vitamin. *This is the antirachitic vitamin; and during the prenatal and the early growing years of life, it is an absolutely essential element for building strong bones and for sound muscular development.*

Lucky for the future presidents of the United States, its industrial giants and its millions of other future leaders that science has discovered another sun—a sun that shines as brightly and effectively in winter as summer—that is richly endowed with health-maintaining ultra-violet—that shines in cloudy weather and in dark and murky cities—that shines in the play room, in the bedroom where the children dress, beside father's easy chair, as he reads about "Ali Baba and The Forty Thieves," that beams down upon the baby's crib and mother's chaise longue.

A sun, sponsored by the greatest name in electricity—General Electric—A sun which shines for three cents an hour . . . *That is safe as the real sun* and as effective . . . That operates without fuss, odor or noise.

Just as a radio tube can **ONLY** function properly in a set designed for its use, the G. E. Sunlight (Type S-1) Lamp **MUST** be used in special equipment to obtain ultra-violet radiation.

TAKING THE SUN'S RAYS APART BY WAVELENGTH IN ANGSTROM UNITS

Sunlight, as the chart above indicates, is composed of electro-magnetic waves of varying lengths which science has classified as infra-red waves, visible light waves, and invisible ultra-violet. Recent scientific investigations, however, tend to show that one particular band in the ultra-violet range is of special importance in the maintenance of general health. This lies between 2800 and 3100 Angstrom units. It is within this desirable ultra-violet zone that the G. E. Sunlight (Type S-1) Lamp concentrates its ultra-violet effectiveness.

Many manufacturers, including General Electric, are offering standards and fixtures, using this new sun—the G. E. Sunlight (Type S-1) Lamp as their source of energy. Special standards or fixtures are necessary because the G. E. Sunlight (Type S-1) Lamp will not operate in the ordinary lamp socket. It is the last word in man-made sunshine. At a touch of the finger, it offers, at a distance of three feet from the lamp, all the benefits and effectiveness of the BEST midsummer sunshine at midday.

Alert mothers will insist that the lamp they buy contains this G. E. Sunlight (Type S-1) Lamp. They will be satisfied with nothing less than the best.

They will not use it as a substitute for the service of a physician in the case of illness or disease, but they will employ it freely as an aid to glowing health not only for the children but for all the family.

The G. E. Sunlight (Type S-1) Lamp is sold in accordance with the requirements of the Council of Physical Therapy of the American Medical Association. For further information and an interesting booklet write The Incandescent Lamp Department of General Electric Company, Nela Park, Cleveland, Ohio.

THE INCANDESCENT LAMP DEPARTMENT
OF GENERAL ELECTRIC CO.
NELA PARK, CLEVELAND, O.

Please send without obligation, full information about the G. E. Sunlight (Type S-1) Lamp.

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GENERAL ELECTRIC
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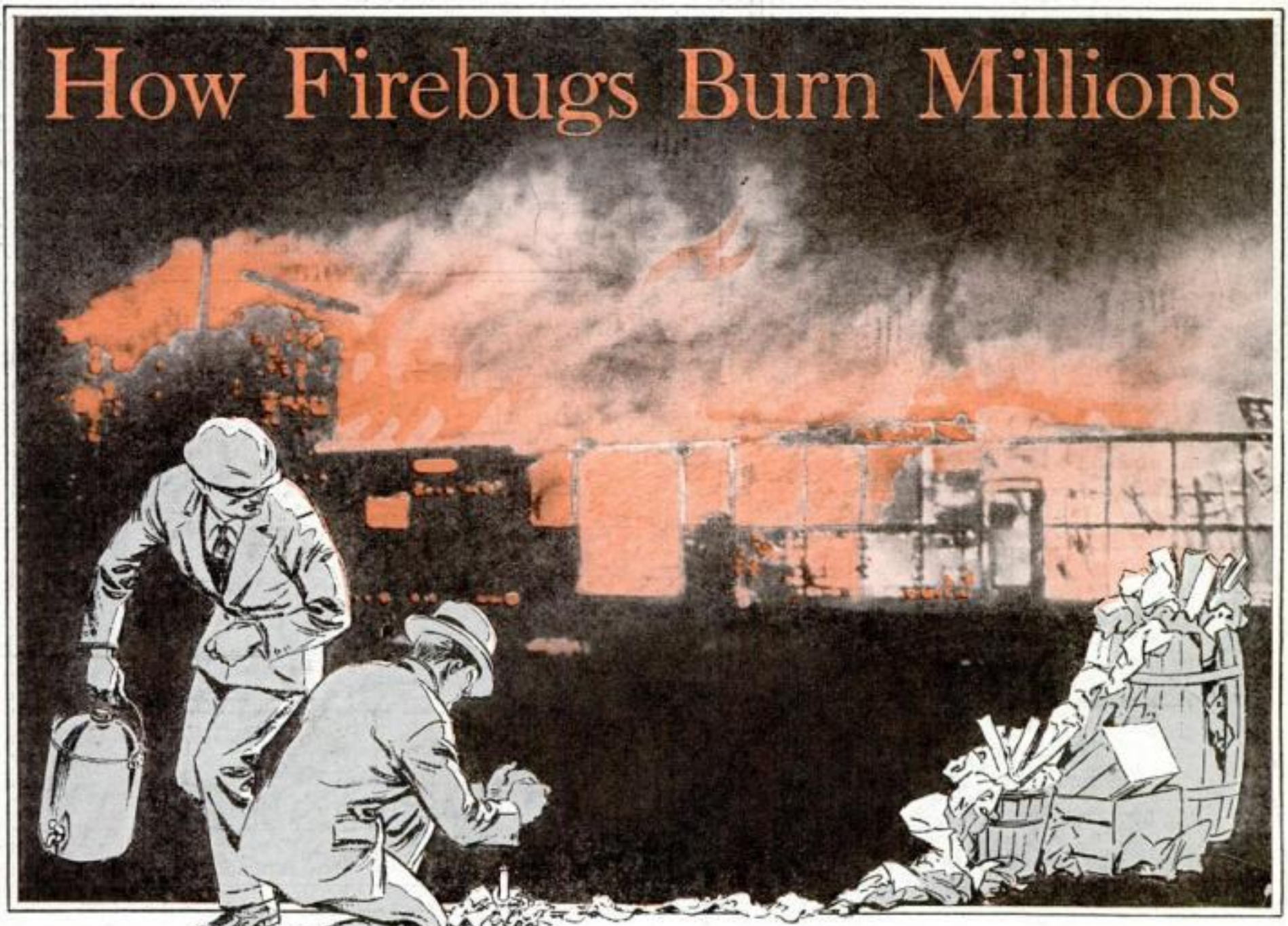
Popular Science MONTHLY

DECEMBER, 1930 RAYMOND J. BROWN *Editor* VOL. 117, NO.

How Firebugs Burn Millions



A highly developed technique of arson enables the firebug to send up in flames millions of dollars worth of property each year and in most cases successfully to escape detection.

By

MICHEL MOK

Criminal Torch Starts One Fourth of All Fires—This Costs You Money

STORES in a big town in western New York had closed for the day when a small delivery truck drew up at the curb of one of the main shopping streets. A few minutes later two men, one of whom carried a bundle, stopped in front of a furniture store just across the street, looked about as if to make sure they were unobserved, and went inside. After a little while, one of them came out, carefully locked the door, and walked away.

The instant he was out of sight, the driver of the truck leaped from his cab and dashed to the back of the store. Soon he returned, dragging by the arm the man who had carried the bundle—a well-dressed, middle-aged individual. The package now was held by the driver, a powerful fellow who, with his free hand, forced the other into the truck.

The few citizens who watched this strange scene, some weeks ago, wondered whether they were witnessing a burglary or a kidnapping. It was neither. It was a clever piece of detective work that ended the criminal career of one of the most dangerous professional firebugs ever caught in this country, and led to the round-up of an arson ring which, during the past four years, had defrauded insurance companies out of $4,000,000.

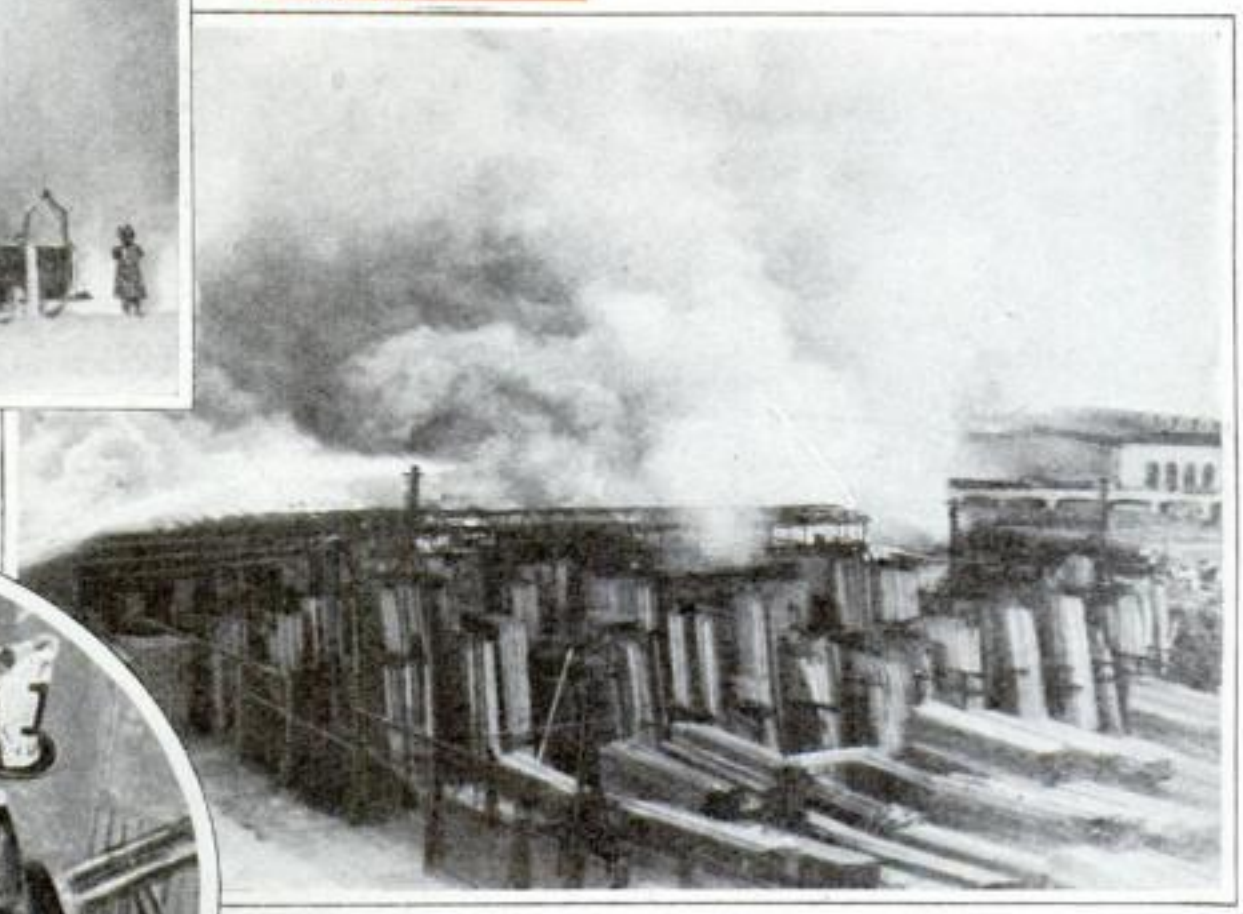
The truck driver was a disguised detective. His prisoner was a man who, for fifteen years, had done a thriving business setting fires for "fees" ranging from $300 to $1,100, depending on the amount of insurance carried by his "clients." He had been the torch thrower in the $1,000,000-a-year arson racket.

For three months the detective had trailed his man. Now he had "the goods on him." He had caught him in the act of setting fire to the furniture store with a contraption designed to provide an explosion and a sure fire—a candle swathed in celluloid. He had found $500 on him, his pay for the "job."

BUT that was not all. From the cab of his truck, he had taken a motion picture of the firebug, the tools of his "trade" under his arm, entering the store with his latest "employer," who thus was identified. The arrest of the owner of the place was a matter of a few hours.

Both confessed and implicated about a

Firemen fight a million-dollar New York apartment house fire cause of which was mysterious.



The fire started for revenge or fraud may get out of control and kill innocent victims. Such may have been the origin of this San Francisco fire.

Firemen are now being trained to look for evidence of arson while the flames rage. At left such inspection is being made.

score of others. The firebug was one of a group of three gangsters who had put arson on an organized business basis. He was the "touch-off" man. The other two were the "boss," who financed the racket, and the "contact" man, whose job it was to "sell the idea" to prospective "customers." Fourteen of the trio's "clients" were arrested. Like the furniture man, they were citizens who, until then, had enjoyed the respect of their community—hotel keepers, real estate men, merchants.

It was the biggest arson catch in years. Day and night, the police of practically every city and town in this country, state and municipal fire marshals, and private detectives conduct a ceaseless hunt for the man who burns to defraud. Almost daily, reports of incendiary or suspicious fires are carried by the leading newspapers in all parts of the United States.

To learn the details of the arson situation, which virtually amounts to a national disease and, in some way, affects the lives of every man, woman, and child in the United States, I recently called upon officials of the National Board of Fire Underwriters in New York City, an organization formed by all of the stock fire insurance companies for purposes of fire prevention and popular education.

For the last ten years, the Board has maintained a special arson department, whose task it is to suppress incendiarism and aid state and municipal authorities in the arrest and conviction of incendiaries. Since last year, the department has been in charge of A. Bruce Bielaski, formerly chief of the Bureau of Investigation of the U. S. Department of Justice, who directs a staff of seventy-five experienced detectives.

IN ten years the arson department has investigated nearly 8,000 fires reported as fraudulent or suspicious. As a result, local authorities throughout the country arrested 3,001 individuals. Of these, 1,445 were convicted.

These, Bielaski emphasized, were merely the convictions. Evidence of arson is difficult to obtain and it is correspondingly difficult to secure convictions. In view of these facts, it is probable, according to Bielaski, that, in the past decade, there actually were ten times as many arson cases as there were convictions—15,000, or about five each day.

Although it is impossible to obtain accurate statistics, careful estimates place the cost of incendiarism at about twenty-five percent of America's total fire loss. In the year 1928—the latest period for which figures are available—the national fire bill amounted to $464,607,102. This comes, roughly, to $880 every minute of the day and night, and of this $220 worth was laid in ashes by someone wielding the torch!

AS incendiary fires are set where they will do most harm, usually with the aid of an inflammable liquid such as gasoline, kerosene, or alcohol, they burn more thoroughly and rapidly than an accidental blaze. Hence, National Board officials calculate that one arson fire costs more

than a dozen accidental fires. For the same reason, they say, arson is responsible for more than fifty percent of the lives of firemen lost in all fires.

Money is mostly but not always the root of the arson evil. Broadly speaking, Bielaski told me, incendiaries fall into four groups. First, there is the man who fires his house, shop, or barn under financial stress. Then there is the incendiary for profit. The third group comprises those who set fires from hatred, revenge, racial or religious prejudice, business rivalry, or to cover up another crime, such as murder or robbery.

FINALLY, there is the pyromaniac, who suffers from a form of insanity the chief symptom of which is an uncontrollable urge to set and see fires.

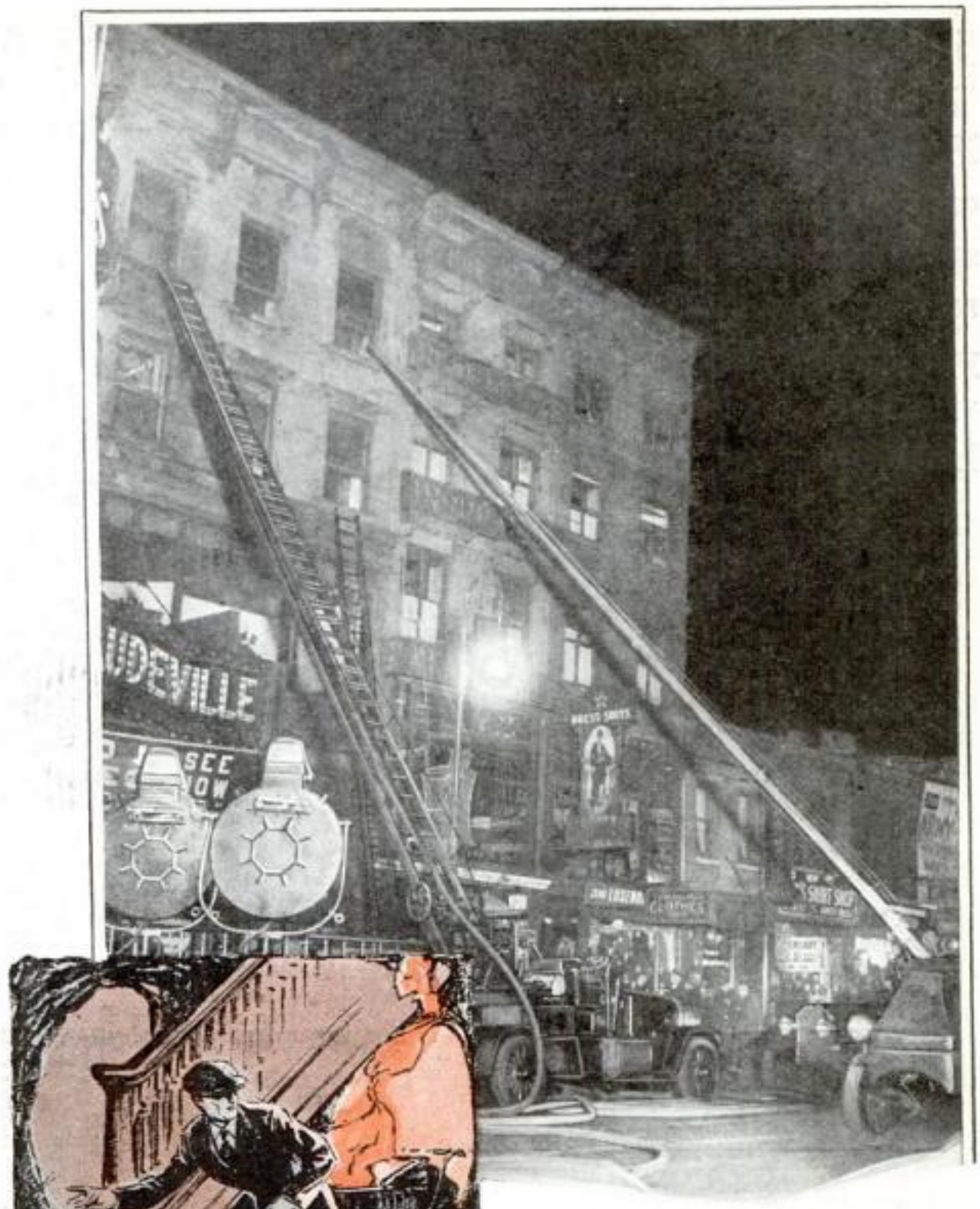
Poverty and despair cause the periodic waves of arson that sweep whole sections of the country in times of business depression. Let the mills or mines in an industrial district, for instance, be shut down for many weeks, and one day an epidemic of fires may break out among the homes of the idle workers.

Probably the most fiendish case of arson for profit on record is that of a man, now serving twenty-five years in an eastern jail, who not long ago fired his house not to collect fire insurance, but to burn alive a man resembling him and thus defraud a life insurance company. To do this, he conceived a plot which, for horror and cunning, surpassed the most imaginative crime fiction.

He took out $100,000 worth of life and accident insurance, making an accomplice the beneficiary. A month later, he visited a municipal lodging house. There he picked out an old derelict whose stature was similar to his own and hired him as janitor for his house in the country. He took the tramp there in his car, plied him with liquor and ordered him to bed.

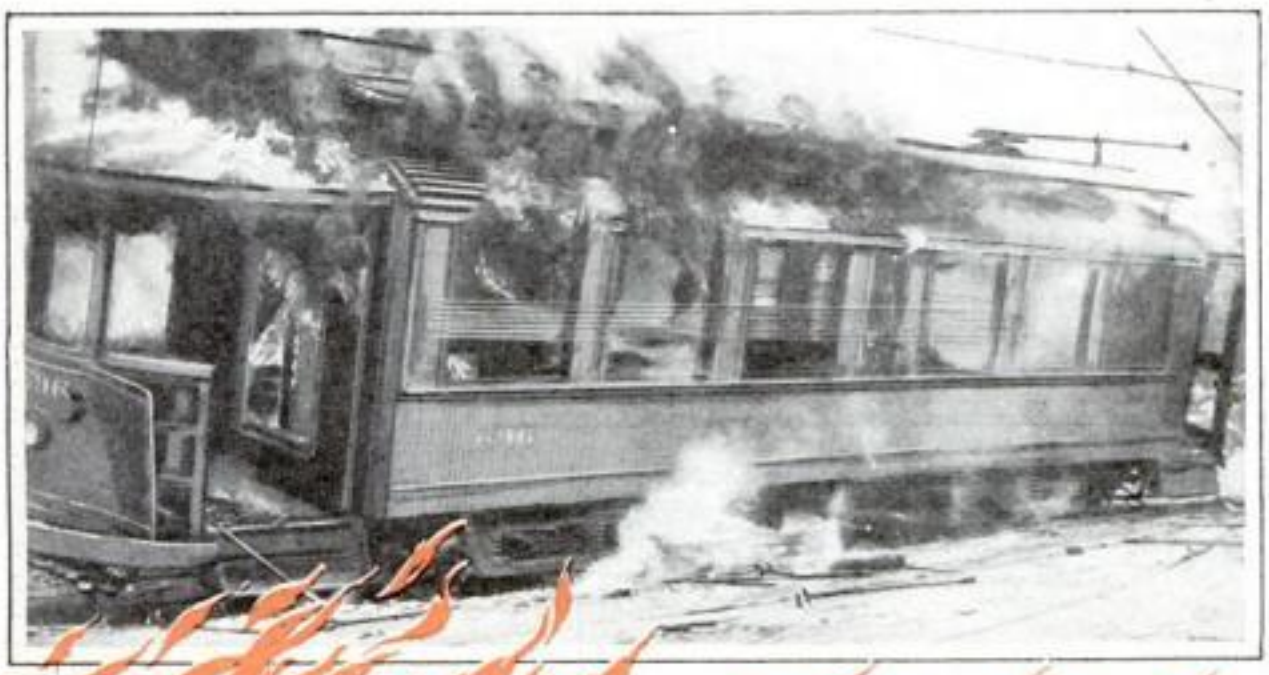
THEN he called on some of his neighbors, giving them the impression he was spending the night alone in his house. On his return, he changed his clothes, placing the suit in which his friends had just seen him in the room of the "janitor," whom he chloroformed. He then set fire to the place.

But the old man was saved from death by the poor quality of the booze he had been given. Violently ill, he awoke, pulled the chloroform-soaked rag from his face, and crawled out of bed. Finding the house ablaze, he tried to escape by the door. It was locked. Screaming at the top of his voice, he jumped from the window of his second-story room, breaking his leg. His "employer" placed him in the care of neighbors who took him to a hospital, and remained behind to help in the work of putting out the blaze.



Three fires that broke out simultaneously and caused three deaths looked like work of firebug.

An insane firebug in New York started many fires in baby carriages before he was caught.



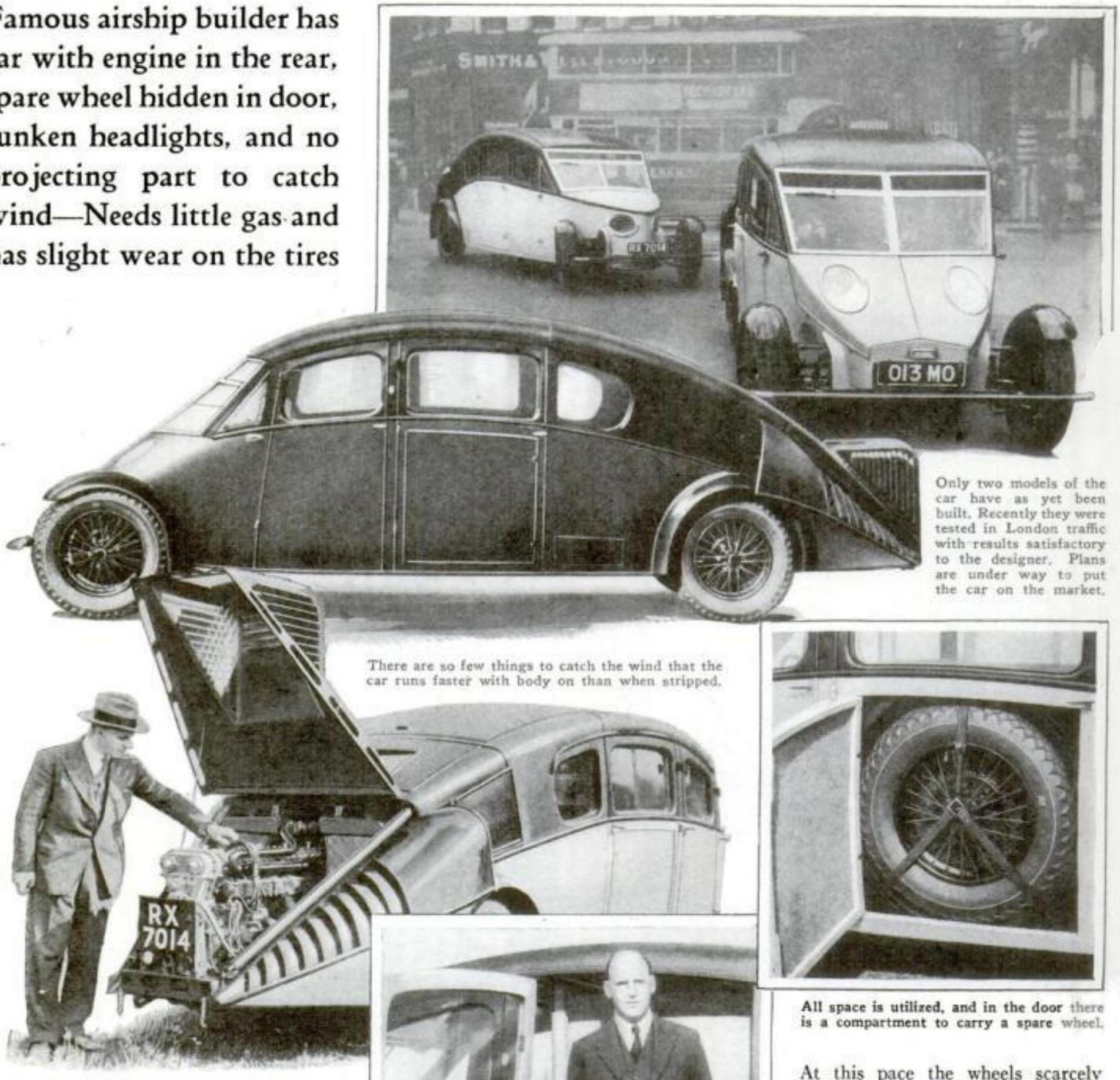
Rioting almost always leads to arson with big property loss. At left, a destructive fire that occurred during New Orleans fight.

THE crime never would have been discovered had it not been for the fact that the culprit, in the unexpected excitement, forgot to put back in the garage his car, which he had left in the road at some distance from the house to make a quick get-away. It was a cold night in the heart of winter. Although the man was a highly respected citizen, this circumstance aroused the suspicions of National

(Continued on page 158)

Streamlined Auto Can Almost Fly

Famous airship builder has car with engine in the rear, spare wheel hidden in door, sunken headlights, and no projecting part to catch wind—Needs little gas and has slight wear on the tires



Only two models of the car have as yet been built. Recently they were tested in London traffic with results satisfactory to the designer. Plans are under way to put the car on the market.

There are so few things to catch the wind that the car runs faster with body on than when stripped.

The engine of the new streamlined car is in the rear, with vents shaped like a fish's gills.

All space is utilized, and in the door there is a compartment to carry a spare wheel.

IMAGINE an automobile that goes faster with the body on it than with the stripped chassis alone. Picture a car that, if it reached a speed of 180 miles an hour, would actually leave the ground and fly for short distances like an airplane. That is a description of a new motor car designed by the famous airship expert Sir Dennis Burney, designer and builder of the giant English airship *R-100*.

Spectators lined the London streets recently when two of the cars received their first try-out in traffic. Streamlined like an airship, their crescent-shaped backs gave them the appearance of monster beetles scooting through the traffic.

On the open road, the car's twenty-two-horsepower motor, concealed in the rear, gives it a speed of eighty miles an hour.

Sir Dennis Burney, designer of the strange auto, which he says will cut fuel consumption in half, planned and built the gigantic English airship *R-100*

At this pace the wheels scarcely touch the ground with a consequent saving in tire wear. Each wheel has independent springs, assuring smooth riding at this speed.

Sir Dennis plans to put his streamlined cars on the market within a short time. He has planned them with the intention of cutting wind resistance in order to economize on the car's gasoline consumption. According to his figures, his car will require only half as much gasoline as a conventional car of equal size.

Two models of the car have been built. Headlamps are sunk, their lenses flush with the body. A compartment in the door carries a spare wheel. The eight-cylinder, water-cooled motor is covered with a hood whose vents suggest the tail fin of a dirigible or airplane.

Captain Wild as he appeared in 1905 when flying his *Eagle No. 1* which is seen at right. In circle, Captain Wild as he is today.

My Forty Years of Flying

The Life Story of a Great Pioneer Flyer

1—Wild Races *in* Rubber Cows

By CAPTAIN HORACE B. WILD

From Kites to Planes

TWENTY years before Lindbergh was born, Captain Wild was busy in the air. Forty-eight years ago, in July, 1882, he made his first flight, clinging to the cross strip of a kite. He has ridden in every form of aircraft from balloons to the latest airplane. Thirty-four years ago he was in the sand hills of Indiana, helping test the gliders that formed the foundation upon which the Wrights built. He helped organize the flying school at Lincoln, Nebraska, where Charles A. Lindbergh learned to fly. He has met and known intimately nearly every great figure connected with aviation and his memories and experiences form a true and absorbing story of flying in America. He is an electrical engineer, an inventor, and a daring experimenter. No other man is better fitted to tell the true story of flying in America.—The Editor.

IN FORTY years of flying, I have looked down upon the earth from every kind of craft that sails the air. I have seen it from the swaying trapeze of a hot-air balloon, from the wicker basket of a Gordon Bennett racing gas bag, and from the cabin of a modern airplane.

In 1906, I flew the first dirigible across the Canadian border, and when I circled the Flatiron Building—I was the second man to perform that feat—it was the only skyscraper in midtown New York. Put end on end, my flying hours would total a year in the air.

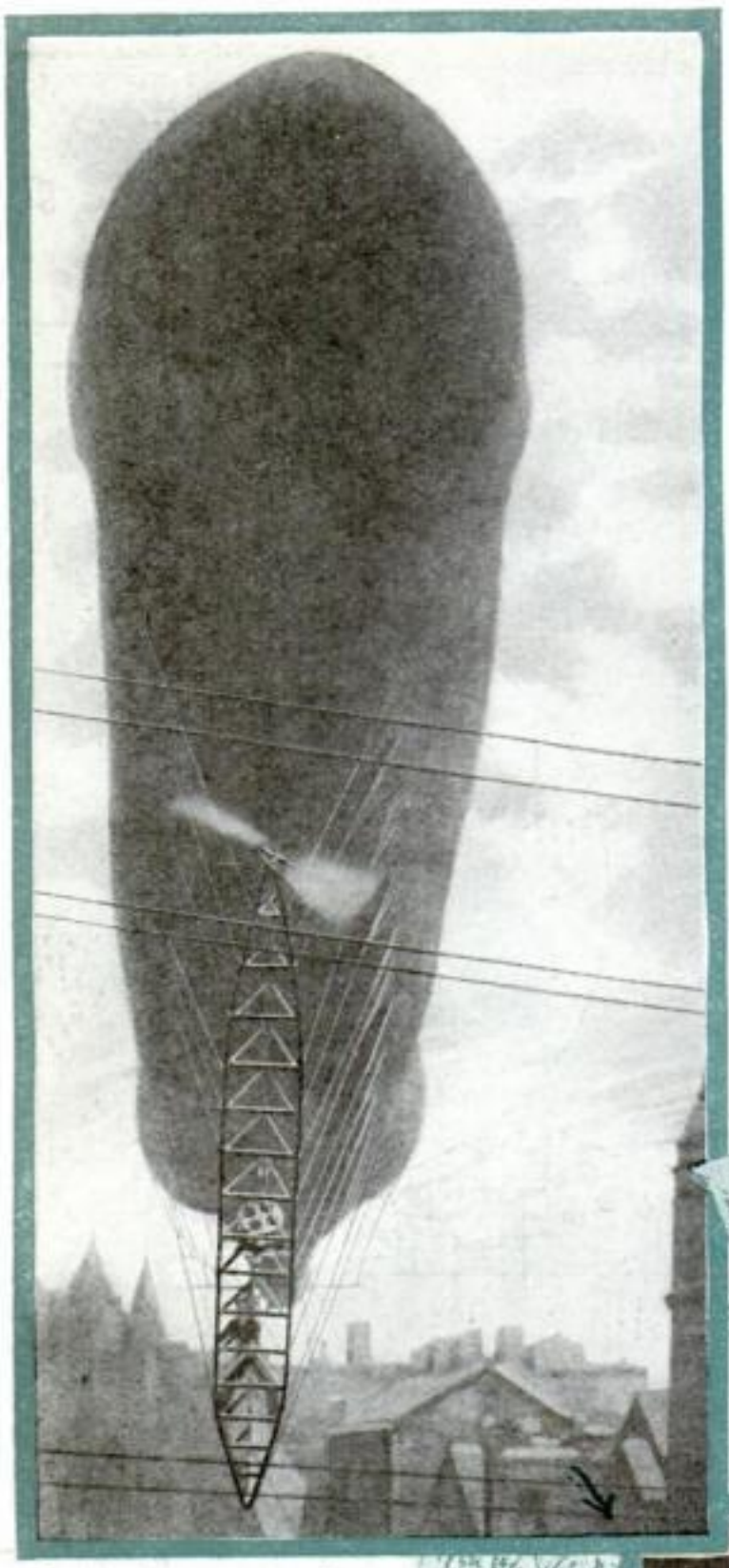
I have had the good fortune to live in the midst of that Arabian Night's tale which is the history of modern flying. I helped Chanute when he flew his pioneer gliders in the Indiana sand dunes, met the Wright brothers before they went to Kitty Hawk, knew Glenn Curtiss when he was a maker of motorcycles in Hammondsport, N. Y.

I flew in Europe with Bleriot, Farman, Latham, Esnault Peltine, and Count Zeppelin, long before the war. I piloted half a dozen types of early planes and I am still flying. Last year I flew a big cabin plane from coast to coast in twenty-nine hours.

Once, when I was up in a dirigible, 10,000 cubic feet of highly-explosive hydrogen burst into flame above my head and I leaped through a hundred feet of thin air and lived to tell the story. But I wasn't as badly scared then as I was when I made my first flight at Hinsdale, Illinois, on the Fourth of July, 1882.

I WAS eleven years old. My father, who had been a balloonist in England associated with the pioneer, John Wise, had constructed a man-carrying kite ten feet high and eight feet wide. Clinging to the cross strip, I was carried 150 feet into the air. Then the kite began to swoop and duck, finally making a straight dive into the top of a high tree. I was scared out of seven year's growth, but otherwise little damaged.

My father occasionally took me to Quincy, a couple of hundred miles from Hinsdale, where Capt. Thomas Scott



In 1906 Captain Wild took off in his *Eagle* to fly over Chicago. When rising he narrowly missed telephone wires.

soiled, he bought new ones along the way, leaving a trail of laundry around the globe. For more than fifty years, "Uncle Tom" played with death, often in far-off places of the earth, and in the end he died in his bed at Quincy, Illinois.

DURING one of our visits in 1889, "Uncle Tom" had eight hot-air balloons at the farm. He asked me if I would like to make a parachute jump from one. I thought I would. That is, I thought so until the bag was 4,000 feet up in the air. Then I decided that I wouldn't and came down with the balloon when the air cooled off. It landed in the middle of a large field and dragged me through half a dozen fences before I could untangle myself. When the bumps and bruises healed, I tried again and this time jumped.

Then I started around the country giving exhibitions at fairs. My first jump of this kind was made at the Wheaton County Fair, not far from Hinsdale. In those days we got from $500 to $700 for making a drop. When I returned home with a roll of bills in my pocket large enough to choke an ox and all for one day's work, I was the hero of the neighborhood.

The next year, I took along a pair of trained goats. They made descents in parachutes that were released by time fuses. I billed them as "Mrs. and Mrs. Murphy, the Billy Goat Aeronauts" and they always caused a sensation. We were traveling with a carnival and I used to ride in a little wagon in the parade pulled by the goats. When we reached Norwalk, Ohio, they caused more of a sensation than I had anticipated. They came down right in the sheriff's front yard near a big bed of geraniums while he was in town at the carnival. To those goats, geraniums were ice cream. They cleaned up the whole bed. The sheriff put the Murphys in the city pound and started looking for me. I had to leave town in a hurry.

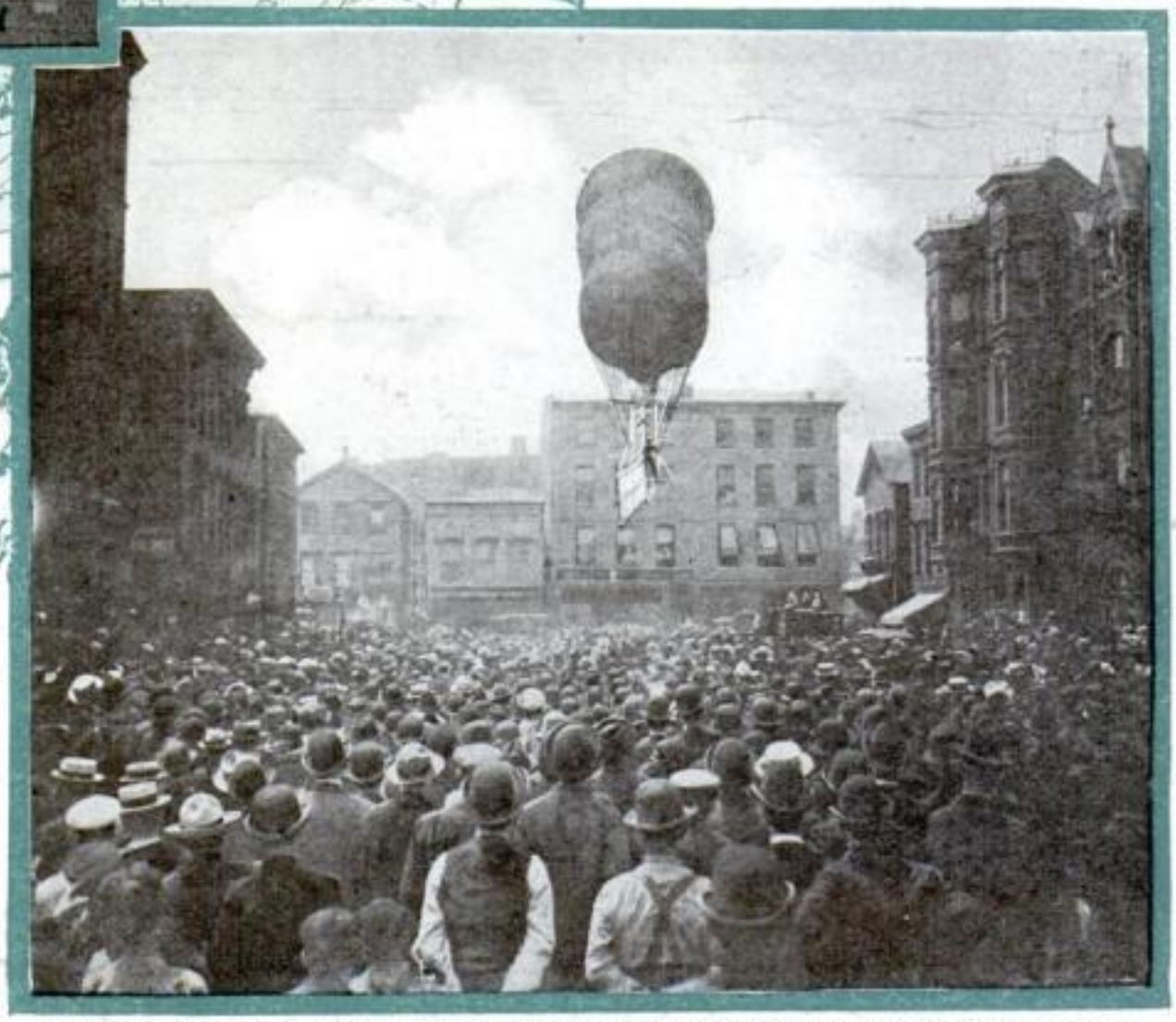
In 1904, Captain Baldwin finished his *California Arrow*, the first successful dirigible built in America. I helped him construct it at Oakland, California. When it passed its tests, we loaded it on a train and started for the St. Louis Exposition to race the great Santos-Dumont, who had come from France to win the $10,000 Grand Prize offered by the Exposition Committee for an airship race.

A millionaire bachelor who owned extensive coffee plantations in Brazil, Santos-Dumont had spent a fortune on his navigable balloons. His flights around the Eiffel Tower in France had stirred interest throughout the world. His airship was built like a watch. Ours looked as though it had been turned out with a butcher knife and a bucksaw. Nevertheless, we had a lot of confidence in it and especially in the little air-cooled motorcycle engine that Curtiss had built for us. The international airship race was to be the climax of the World's Fair, and as the day

Baldwin had his famous "balloon farm." Baldwin was one of the most interesting characters I have ever met. Everybody called him "Uncle Tom." He began as a professional tight-rope walker and when he was past forty he did a balancing act on a rope stretched from Seal Rock to Cliff House at San Francisco.

Soon after the Civil War, he took to balloons, traveling around the world and making parachute jumps before most of the crowned heads of Europe. He originated the idea of selling his jumps by the foot—a dollar a foot and 2,000 feet the minimum.

In 1911, at the age of 60, "Uncle Tom" started out on another round-the-world exhibition tour, this time taking along his brilliant crimson *Red Devil* biplane and making the first airplane flights seen in the Orient. On such journeys, Baldwin would start out with a small hand bag as luggage. When his shirts and collars got



Wild just clearing the buildings in an ascension from West Erie Street, Chicago, in the presence of an immense throng gathered to see the flight of one of the first dirigibles in this country. Once a 240-pound woman grabbed his dragrope and wouldn't let go. He had to cut it with a knife.

approached excitement increased.

The time arrived. Santos-Dumont's dirigible was found to be out of commission. It could not fly. All we had to do to win the $10,000 prize was to round the course—even if it took all day. "Uncle Tom" climbed up on the framework with a wide smile. The assistants adjusted the sandbags.

"Are you ready?" Baldwin asked in a loud voice.

"All ready."

"Then, men, *let go!*"

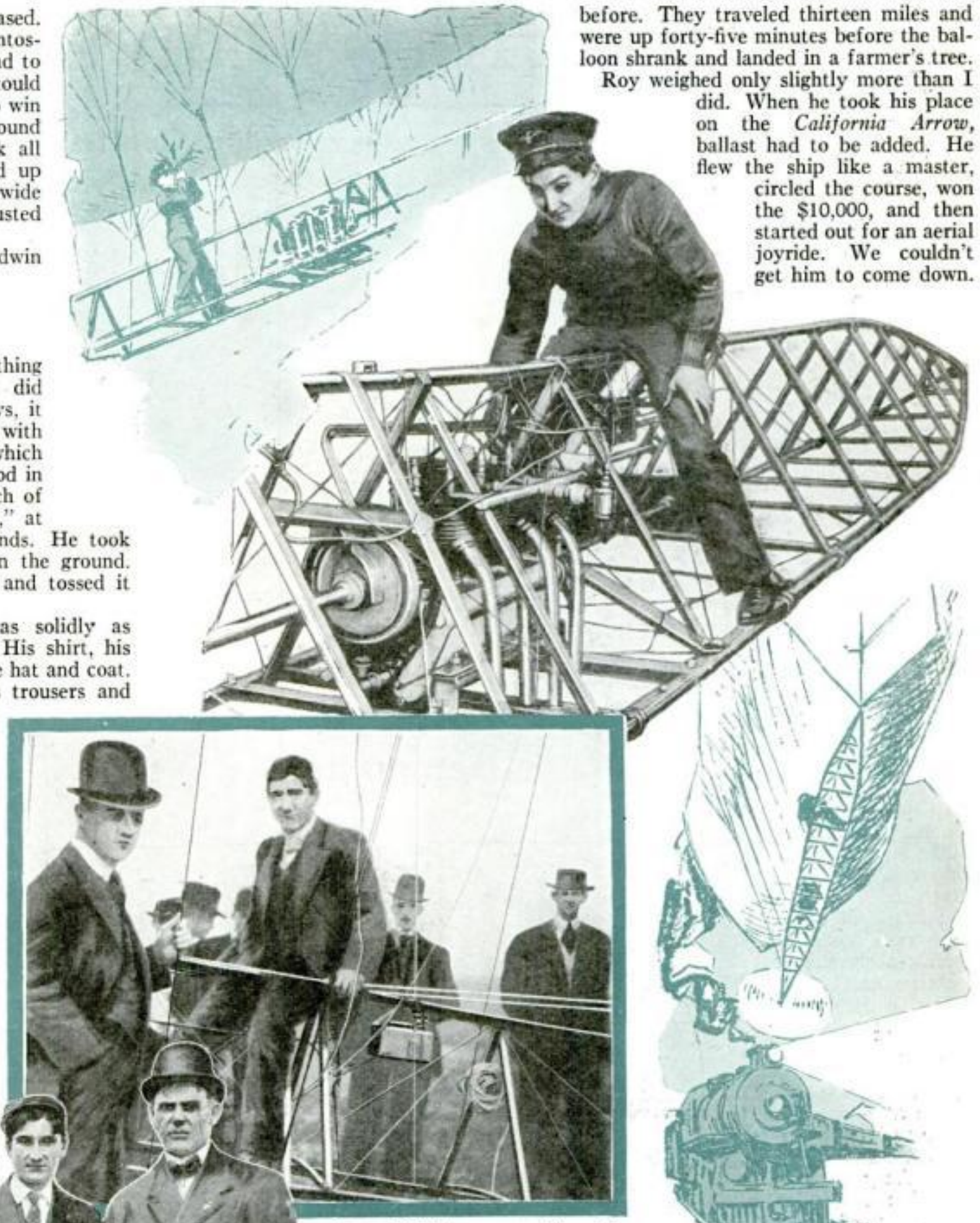
THEY all let go. Nothing happened. The airship did not budge. For several days, it had been standing around with the bag filled. The gas, which probably wasn't any too good in the beginning, had lost much of its buoyancy. "Uncle Tom," at the time, weighed 227 pounds. He took off his hat and threw it on the ground. Then he took off his coat and tossed it overboard.

The dirigible squatted as solidly as before. His face got red. His shirt, his shoes, his socks followed the hat and coat. When he was down to his trousers and undershirt the ship trembled a bit but didn't rise. The crowd cheered. Then, the air turned blue as "Uncle Tom" expressed himself at length on the situation. Ten thousand dollars dangled before his eyes and his airship had turned into a groundhog.

I weighed only 110 pounds and had been groomed to fly the machine if anything happened to Baldwin. But I was on crutches with a sprained ankle and could not go up. The only other fellow there who knew anything about balloons was Roy Knabenshue, a boy from Toledo, Ohio. His father was editor-in-chief of the Toledo *Blade*. Two years before, he had made his first balloon flight during the Tri-State Fair.

With his brother, Paul, he went up in a captive balloon at the fair grounds and then cut the rope. The gas bag shot straight up into the clouds to a height of over a mile. Neither of the boys had ever been in a balloon before. They traveled thirteen miles and were up forty-five minutes before the balloon shrank and landed in a farmer's tree.

Roy weighed only slightly more than I did. When he took his place on the *California Arrow*, ballast had to be added. He flew the ship like a master, circled the course, won the $10,000, and then started out for an aerial joyride. We couldn't get him to come down.



At top, Wild is seen astraddle of the framework slung beneath his dirigible. Above, left, biting open an air valve.

Three pioneers of flying in one group. From left to right, they are: Glenn H. Curtiss, Captain Wild, and Captain Baldwin.

An express train missed Wild's car by a narrow margin. He saved himself by throwing away battery, lightening ship.

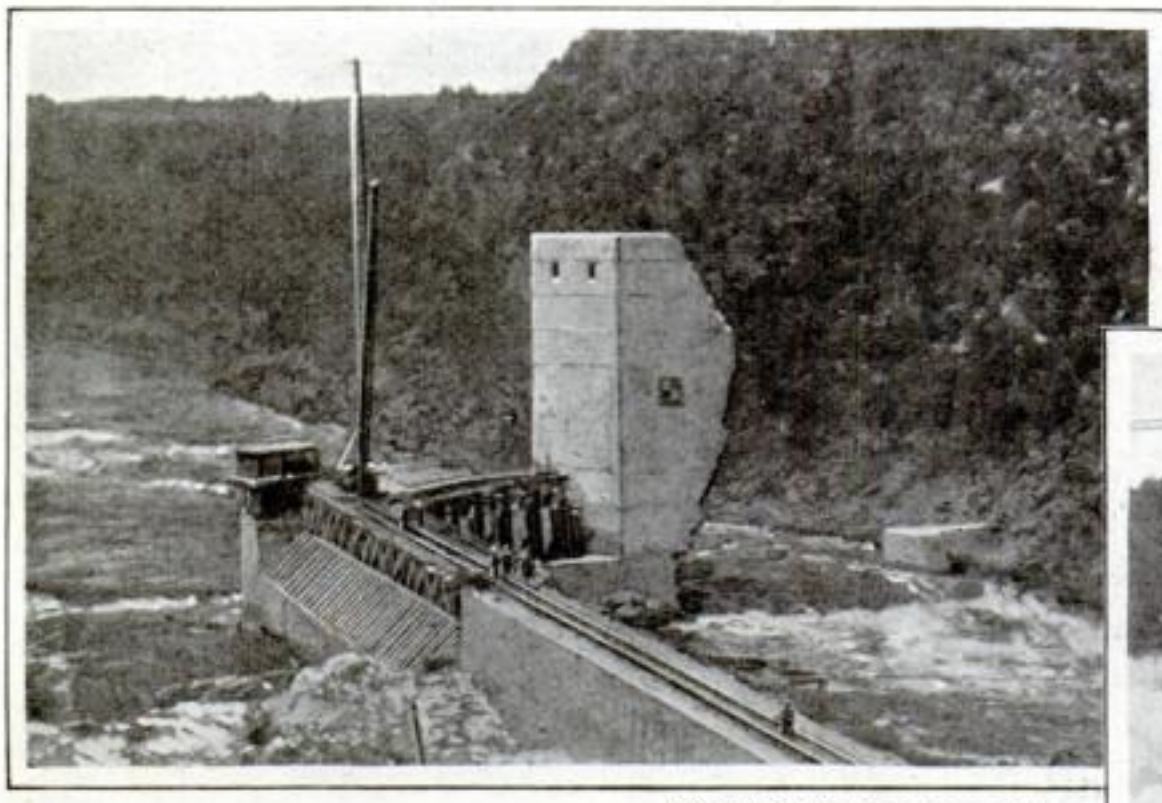
He circled and dipped and finally crossed the Mississippi and landed on the Illinois side when the sprocket chain broke.

The whole country read of the flight. Knabenshue was the Lindbergh of 1904. Girls from a dozen different states wrote, asking to be taken for rides. The following year he piloted a dirigible of his own and gave exhibitions all over the East. Later, he joined the Wright brothers and managed their exhibition team in the palmy days of 1910 and 1911.

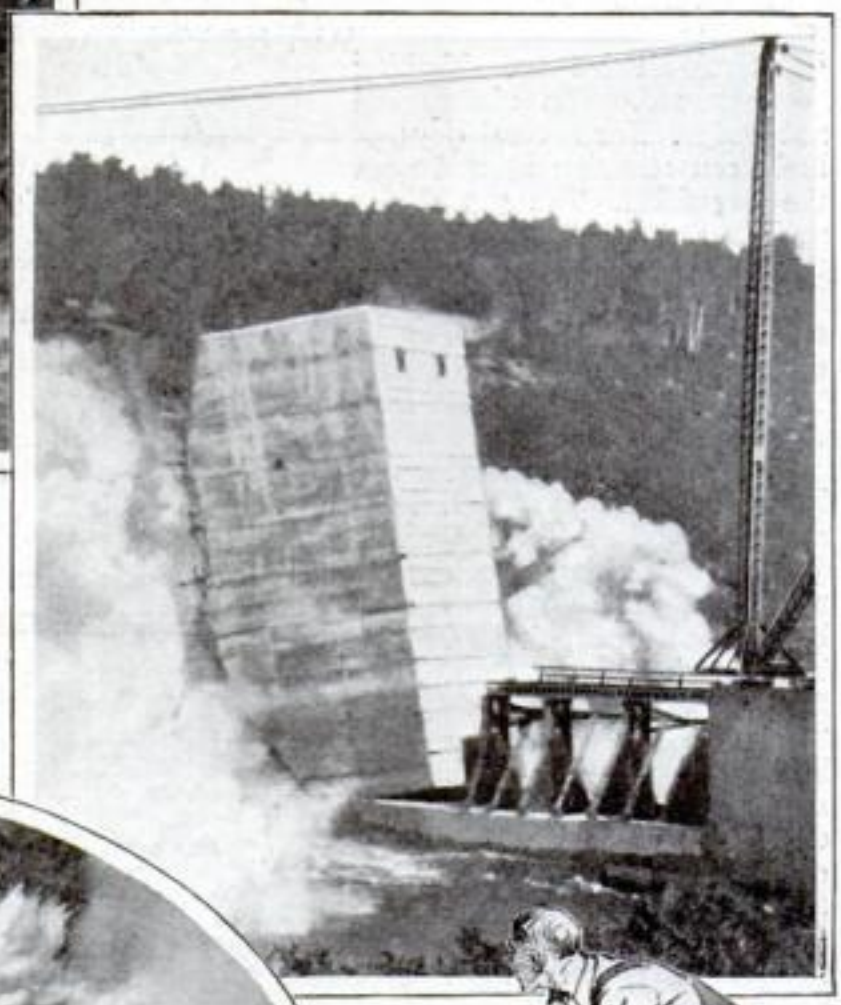
As an example of how little we foresaw the amazing future of aviation in those early days, when Knabenshue crept over the buildings of New York City on his ten-mile-an *(Continued on page 150)*

Dynamite Hurls Dam into Place

Concrete plug, 92 feet long and 45 feet thick, weighing 11,000 tons, is built on pier and blasted into river channel



When finished, the concrete plug stood on a pier at the river's edge and towered 92 feet into the air. When its support was blown away, it fell to the right, coming within six inches of the pier that can be seen on the far right, and effectually blocking the swift, deep Saguenay River.



Touching off the blast of dynamite. The dam is just beginning to fall.

A DEAFENING blast of dynamite. A pier is blown away like a cardboard box in a storm. A gigantic concrete "plug," the size of a nine-story building, drops into the river. Roaring up like a mighty geyser, water is thrown hundreds of feet into the air.

In this manner, a large diverting dam, the world's first to be put in position in a single operation, was placed in the Saguenay River, in Canada. The feat has been hailed as one of the boldest engineering achievements of recent times.

The entire job was done in about six seconds. Months, however, had been spent in preparation. Models were built of the enormous "plug," which really was a great obelisk, ninety-two feet high, forty feet wide, forty-five feet thick, containing 5,500 cubic yards of concrete and weighing 11,000 tons. Slow motion pictures were taken of these models dropping into place. By means of the movies, the probable falling course was studied thoroughly by all concerned. So carefully was the scheme worked out that, when the huge block of concrete was toppled into the river, it dropped within less than one inch of the place where it had been expected to land.

This novel and daring engineering procedure was necessitated by the swiftness and depth of the water. The Saguenay River has a flow varying from 35,000 minimum to 225,000 maximum cubic feet a second.

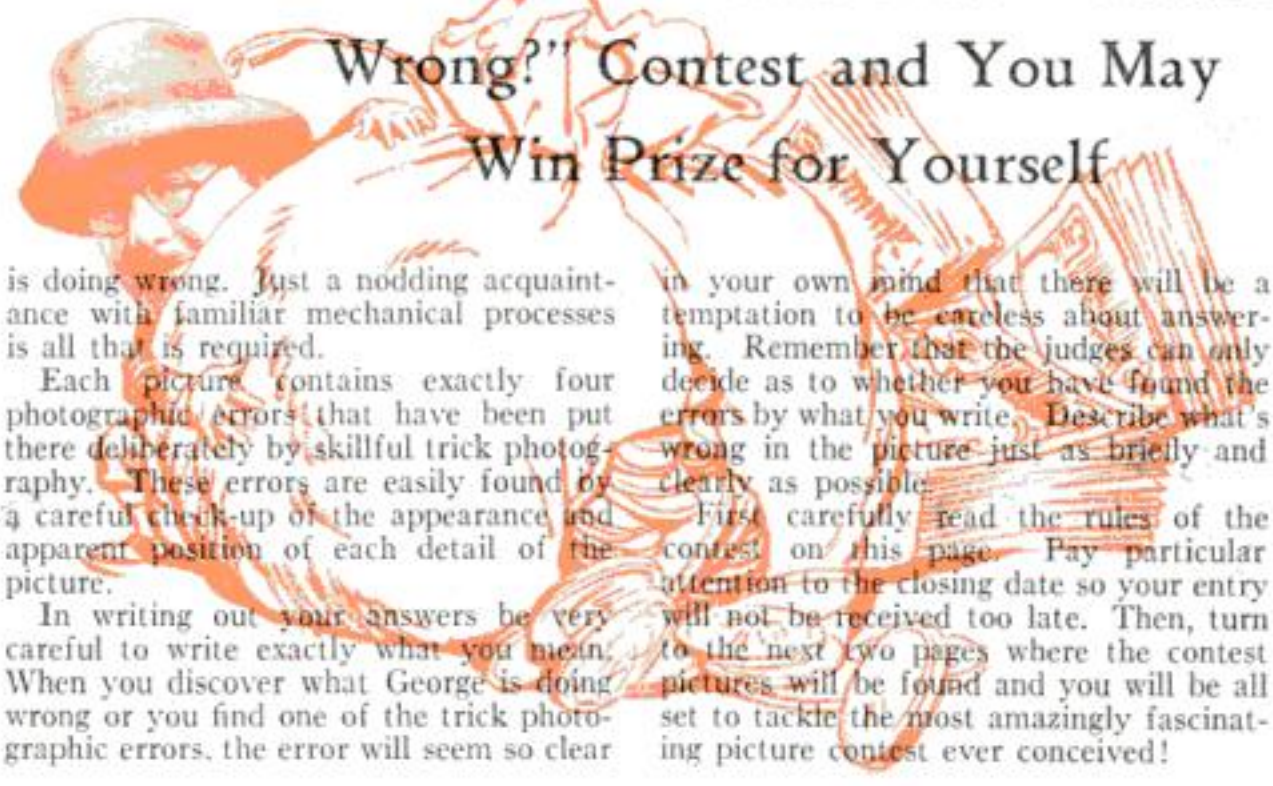
At Chute-a-Caron, about 140 miles north of the city of Quebec, the Alcoa Power Company, Limited, a subsidiary of the Aluminum Company of America, has under construction a large hydroelectric power development.

The site of *(Continued on page 154)*

In oval, the dam plunges home, throwing great geysers of water hundreds of feet into the air. As the river quieted, the dam can be seen resting firmly in place and fitting almost perfectly.

$1,000 Cash Prizes

Find the Mistakes in This New "What's Wrong?" Contest and You May Win Prize for Yourself



WHAT YOU MAY WIN IN THIS NEW CONTEST

READ the rules carefully, find all the errors, and then send in your list. You may win one of these sixty-three cash prizes:

First Prize	$500
Second Prize	100
Third Prize	50
Ten Prizes, $10 each	100
50 Prizes, $5 each	250
Total Monthly Prizes	$1,000

HERE'S another chance for you to win a big cash prize! Five hundred dollars for first! Sixty-three cash prizes in all totaling one thousand dollars! All you need do is to spend a few minutes studying the four pictures on the following two pages. In each of them George Knowitall, the world's champion dumbbell, is doing a mechanical job in the wrong way, and there are also four errors deliberately made by trick photography. When you find the errors, send us a list of them as directed by the rules printed elsewhere on this page and you will be eligible for a prize.

This month's big prize contest is the third in a series of four POPULAR SCIENCE MONTHLY tests of your observation and common sense. The first two contests appeared in the October and November numbers. The fourth will appear in the January issue.

The prize list totals one thousand dollars for each separate contest. Winning a prize in one contest does not bar you from the next contest. It is possible, though of course extremely unlikely, that the same person might win first prize in all four contests—and get a total of two thousand dollars in cash!

Surely nothing could be more interesting than to spend a few minutes finding out what that good-natured blunderer, George Knowitall, is doing wrong and then a few minutes discovering the four other errors in each picture. You probably won't see any of them at first glance, but when these weird photographic errors are once found, you will wonder how you could have overlooked them!

Knowitall is pretty stupid. No expert knowledge is needed to figure out what he is doing wrong. Just a nodding acquaintance with familiar mechanical processes is all that is required.

Each picture contains exactly four photographic errors that have been put there deliberately by skillful trick photography. These errors are easily found by a careful check-up of the appearance and apparent position of each detail of the picture.

In writing out your answers be very careful to write exactly what you mean. When you discover what George is doing wrong or you find one of the trick photographic errors, the error will seem so clear in your own mind that there will be a temptation to be careless about answering. Remember that the judges can only decide as to whether you have found the errors by what you write. Describe what's wrong in the picture just as briefly and clearly as possible.

First carefully read the rules of the contest on this page. Pay particular attention to the closing date so your entry will not be received too late. Then, turn to the next two pages where the contest pictures will be found and you will be all set to tackle the most amazingly fascinating picture contest ever conceived!

Rules of the Contest—Read Carefully

1. Each month for four months, beginning with October, POPULAR SCIENCE MONTHLY is printing four photographs depicting the adventures of George Knowitall. In each picture, Knowitall is doing some mechanical job in the wrong way. There are, in addition, four errors in each picture put there by trick photography. You are to tell us what Knowitall is doing wrong and what the photographic errors are in each picture.

2. Prizes will be awarded to those persons who point out these errors most accurately and clearly and in the most skillful manner. In case of ties, the full amount of the prize will be awarded to each tying contestant.

3. Answers to each monthly contest must be mailed or delivered to the offices of POPULAR SCIENCE MONTHLY not later than the thirtieth of the month following the date of publication of the magazine in which the pictures appear. Thus, to assure consideration in this month's contest, answers to the pictures in this month's issue, published November 3, must be mailed or delivered not later than December 30. No entry bearing a postmarked date later than the closing date for entry will be considered.

4. Answers may be submitted on any kind of paper, but they must be typewritten or written in ink, and on one side of the paper only. Each error must be listed separately and numbered. No changes or corrections will be allowed in any entry after submission, but any contestant may submit as many separate entries as he desires.

5. All entries should be addressed to the Picture Contest Editor, POPULAR SCIENCE MONTHLY, 381 Fourth Avenue, New York City. Name and address of the entrant must be written plainly on each page of the entry. Entries with insufficient postage will not be accepted. The publishers cannot be responsible for delay, loss, or nondelivery of entries. No contribution entered in this contest will be acknowledged and none will be returned. No letters of inquiry regarding points covered in the rules can be answered.

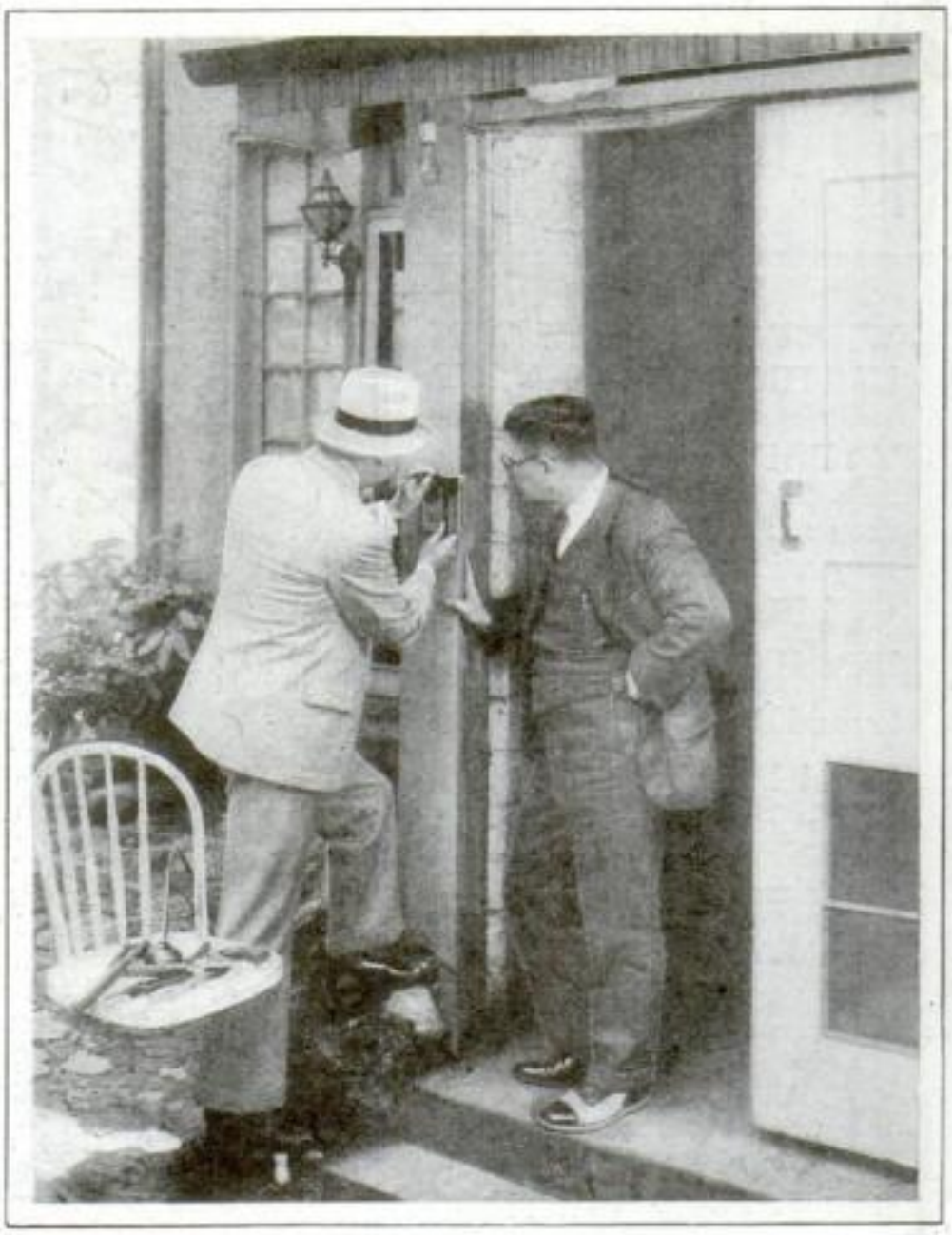
6. There is no entry fee. You need not buy POPULAR SCIENCE MONTHLY to compete. You can borrow a copy from a friend or you can examine one at any office of POPULAR SCIENCE MONTHLY or at the public libraries free of charge. Each contest is open to everybody, except employees of POPULAR SCIENCE MONTHLY and the POPULAR SCIENCE INSTITUTE and their families.

The officials of the POPULAR SCIENCE INSTITUTE will act as judges and their decision will be final. The judges will work as expeditiously as possible in arriving at their decision, and the names of the winners will be announced in an early issue of the magazine.

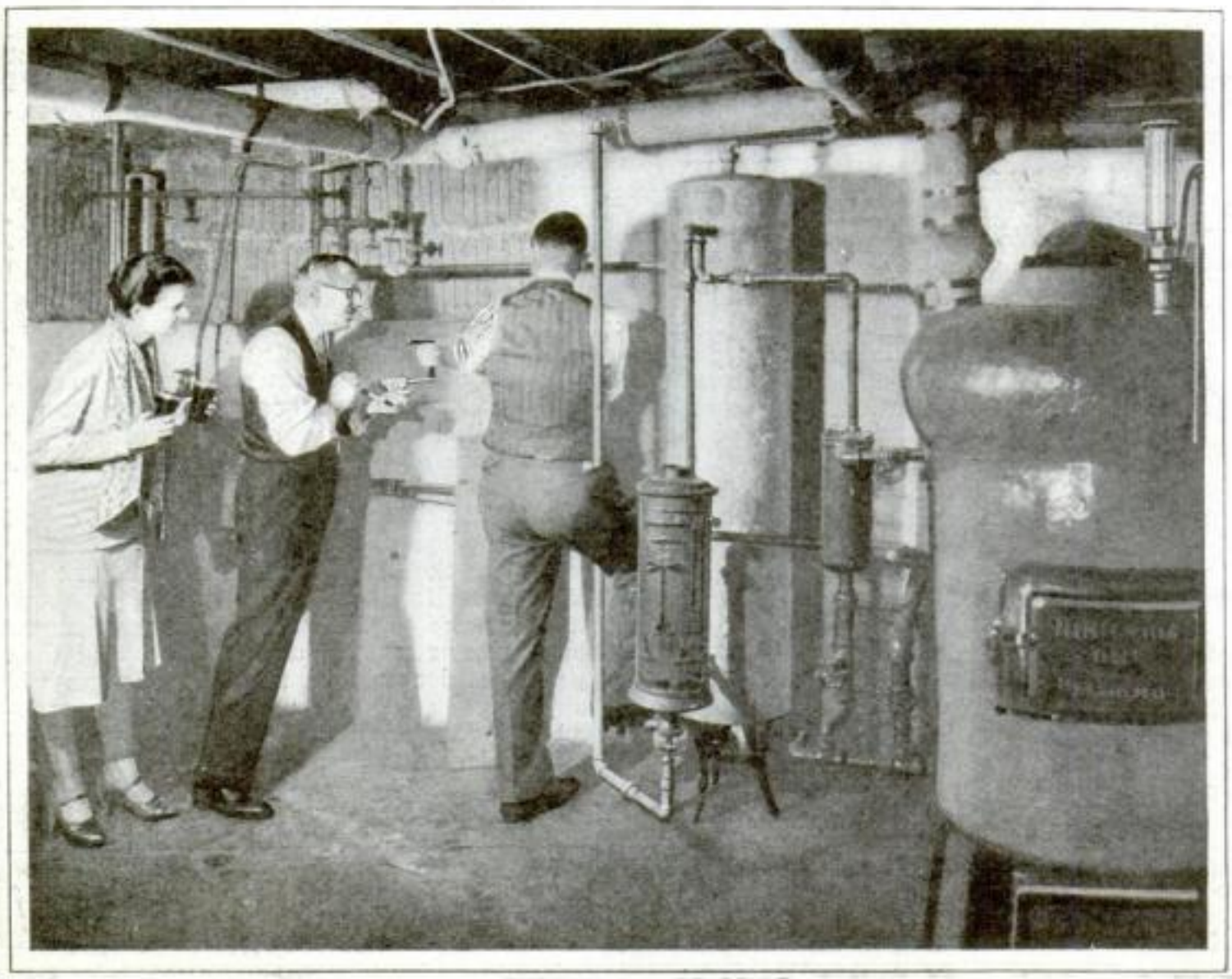
Another Contest Next Month—Watch for It!

Find Five Errors in Each Photo: $1,000 in Prizes

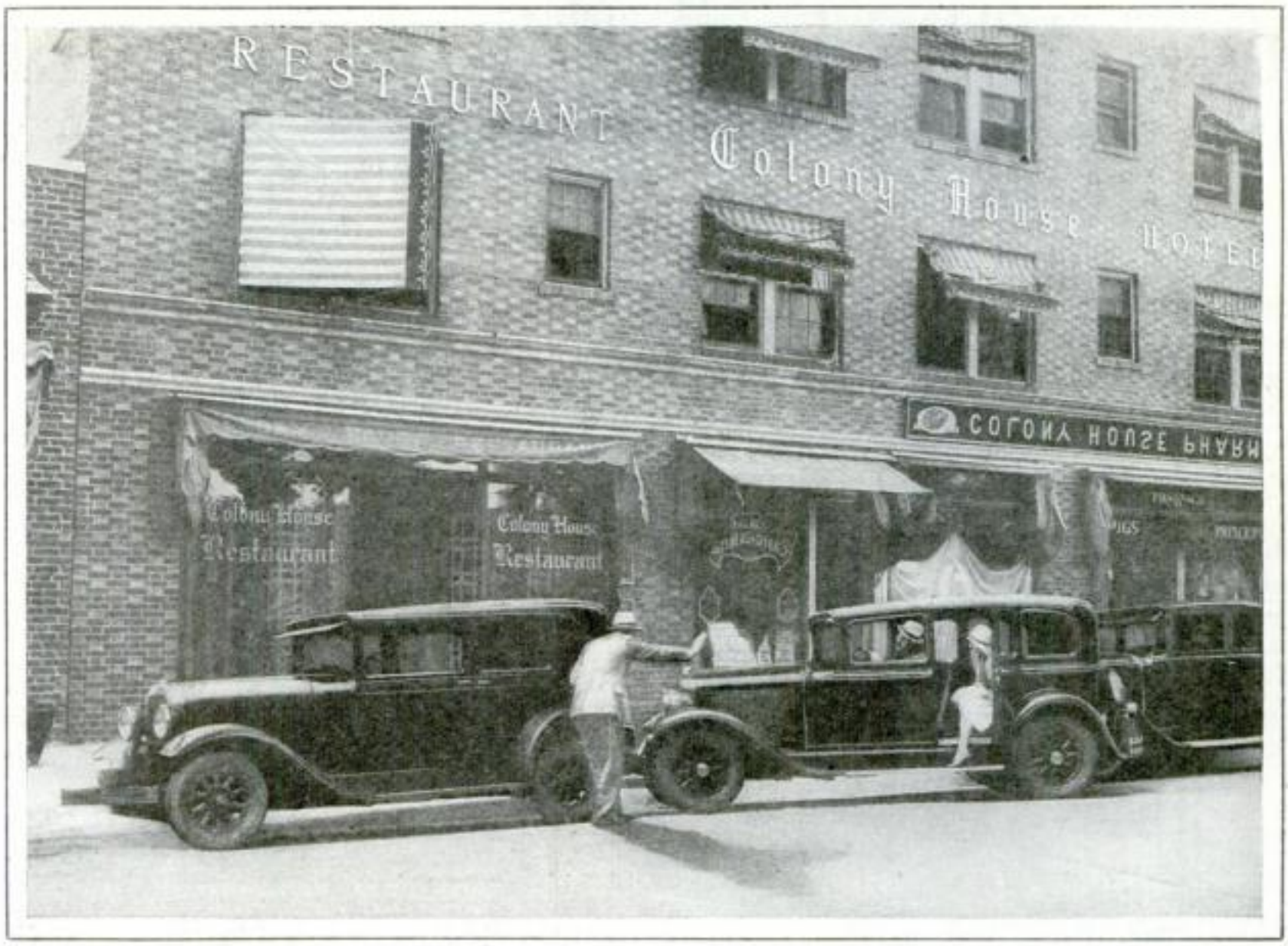
What errors can you find in each of the pictures on these two pages? In each of them, George Knowitall is busy making a mistake, and besides, in each there are four errors deliberately put there by expert trick photography. Find these five mistakes in each of the pictures, send us your answers, and you may win one of the big cash prizes listed on page 27. First, read the rules carefully on the preceding page and then study pictures for errors.



George Knowitall may not be a locksmith but you may be sure he will never admit it. Here you see the kindly soul installing a lock for the sliding main door of his friend's garage. Do you have any trouble seeing what he's doing wrong? The trick camera has put in four other mistakes that are easy to find. Do you see them all at the first glance?



Whenever there's anything to be done, our George is always there to do it. Putting up a shelf in the basement for his friend's wife is just child's play to him. So he starts, with a brace and bit, to drill holes in the concrete for the bracket screws. Do you fancy everything is going all right with him? Of course there are four other errors in this picture but they're easy to find.

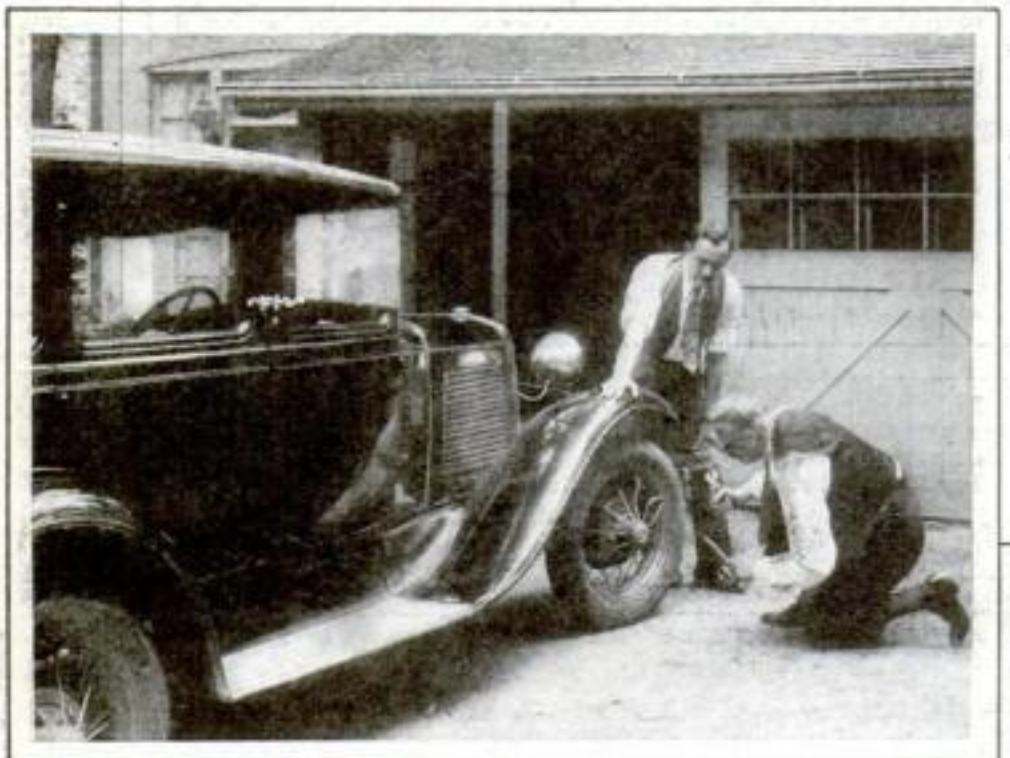


Doubtless George Knowitall is a great driver, but the one specialty about which he has done a great deal of bragging is his ability to park in a limited space on a busy street. In the picture above he is demonstrating this self-acclaimed knowledge and skill. Will he, do you think, get the car parked in time to go home? Don't spend all your time on George, as there are four other errors in this picture that were put there deliberately by trick photography. That makes five in all for you to find. Each of them is perfectly plain and easy to see—if you use your wits and your eyes.

Wise old George doesn't exactly pose as a great chef but he does claim to know all there is to know about a gas range. So when a gas line was clogged in this stove, he volunteered to fix it in a jiffy. He got the gas flowing and lighted it with the result you see. Maybe you'll find he made a mistake. Don't forget to find the other four errors that slipped into this photo.

You Still Have Time to Share This $1,000

Just to give you every possible chance in our big *"What's Wrong?"* contest, we are here reproducing, in a smaller size, the photos that appeared last month. The November issue, in which these pictures ran full size, can be seen in public libraries or at any office of this magazine. Read the rules, find the errors in these pictures, and send in your list before November 30.



George never ran a garage but surely he can put spokes in the wheel of his friend's Ford. You can see him here, with repair wire in his hand, busily engaged in getting the broken spokes out. Is he doing anything wrong? Also there are four other mistakes for you to find.

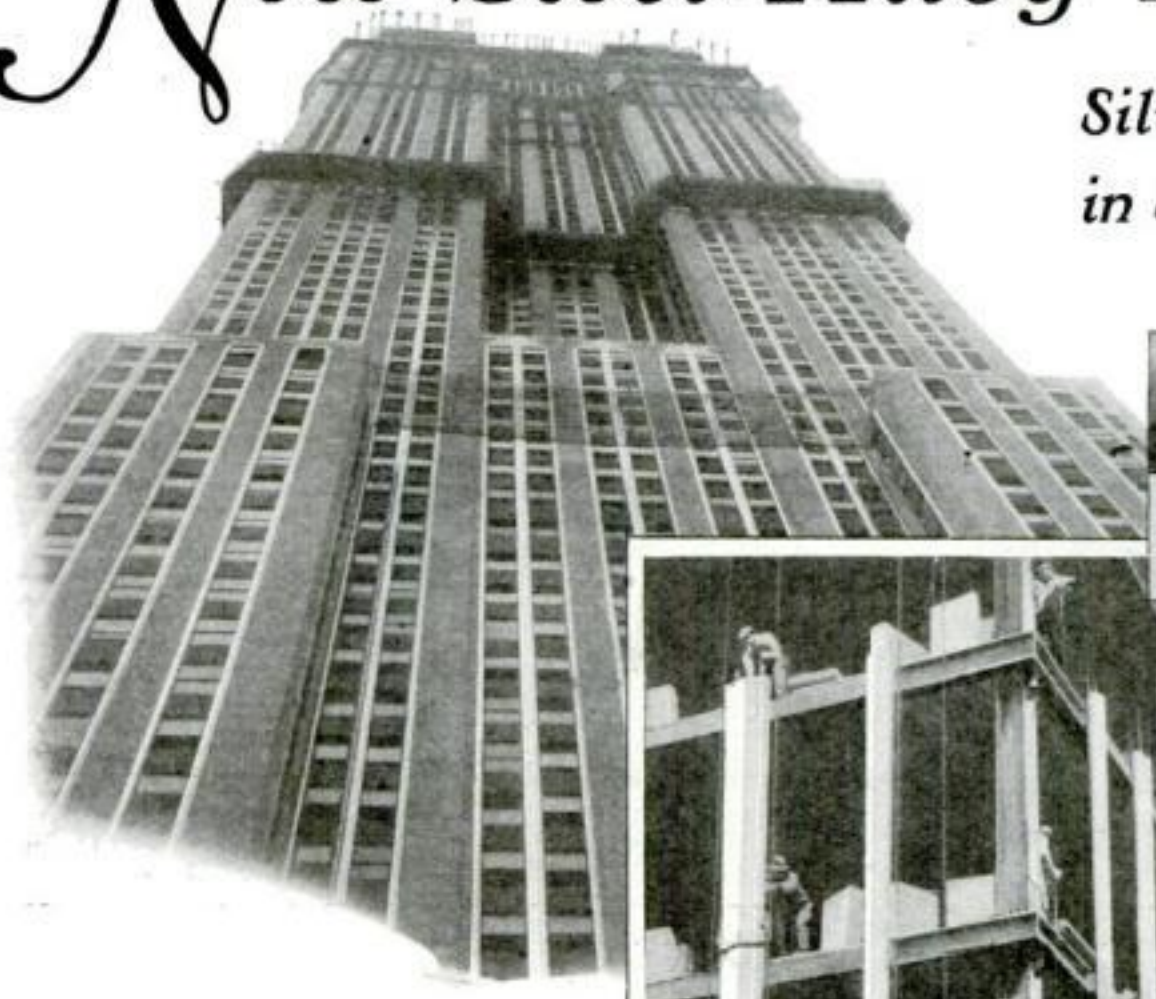
Genial George always likes to please the ladies and so he was eager to put hooks in the china closet to hang the cups on. After all, will the lady be pleased, do you think, when the job is finished? Four other errors have been photographed into this picture for you to find.

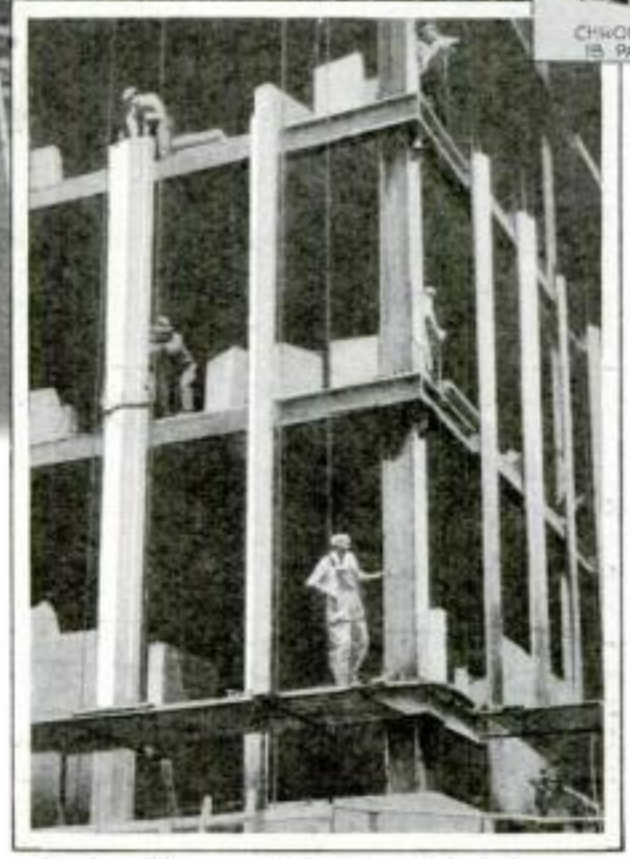
When his friend's doorbell wouldn't ring, Knowitall was delighted because that gave him a chance to do something for his friend. At once he set out to put the thing in shape. First he threw away the dead batteries and showed his friend how to hook the bell to the light circuit. Here he is connecting the wires. Will everything be all right? What are the other four mistakes?

At left, the best program of the evening has been suddenly interrupted by a burned out tube and our old friend George has rushed to the rescue. His friends believed him when he said he was a radio expert and expect to hear music any minute. George, however, has spent a lot of time trying to put another tube in the set. Do you think he's likely to succeed? Don't forget, there are four other errors in this picture for you to discover.

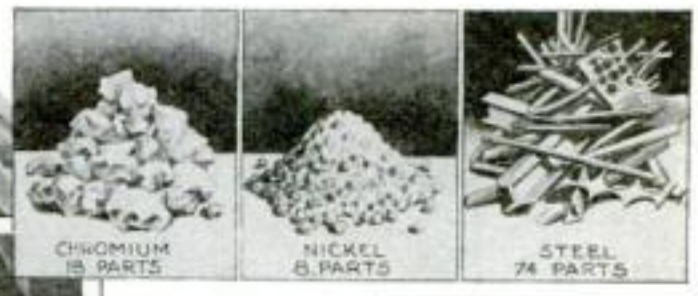
New Steel Alloy Is Rustproof

Silvery Metal Finds Place in Skyscraper and Kitchen





Strips of the new steel alloy which defies rust go onto the exterior of Empire State Building.



Showing how rustless steel is a combination of chromium, nickel, and low carbon steel.

By
ALDEN P. ARMAGNAC

A PROCESSION of trucks halted at the site of the Empire State Building, now under construction in New York, the other day. Workmen began to unload curious eleven-foot parcels in paper cartons. Over the wooden superstructure and up the side of the rising eighty-five-story structure they were hoisted, still in their wrappings.

Each carton contained a piece of steel. But the workmen guarded this steel as carefully from scratching as if it were precious metal. When the pieces were bolted in place they made silver ribbon-like lines from the sixth to the top floor.

This strikingly handsome metal is something brand-new in metallurgy. "Chromium-nickel steel," as it is called, is the dream of a steel-worker come true. It is the first alloy of steel ever developed that can absolutely defy red rust.

A British chemist's search for an alloy to line gun barrels gave the first clue that such a metal existed. Now metallurgists have perfected it. Last year 25,000 tons of it were manufactured in this country under such names as "Allegheny metal" and "Nirosta steel," and its makers have found that it can be used for every conceivable purpose in home and industry where a white metal is desired.

KITCHEN utensils—frying pans and double boilers—are on the market, made of the new rustless steel alloy. A well-known maker of automobiles recently began to make polished radiator shells and other fittings out of the alloy.

The new steel is descended from the "stainless steel" used in cutlery, and like that metal it is a solid alloy. Consequently wear and tear cannot harm it.

When Harry Brearley, of Sheffield, England, sought a new alloy for gun linings, he turned to chrome steel, of which armor plate is made. It contains about one percent of chromium metal. Brearley tried adding twelve times that amount of chromium to the steel in his crucible.

He gave some of the alloy to a Sheffield manufacturer, who made a table knife of it. By accident, the first knife was left lying on the ground, in a garden, overnight.

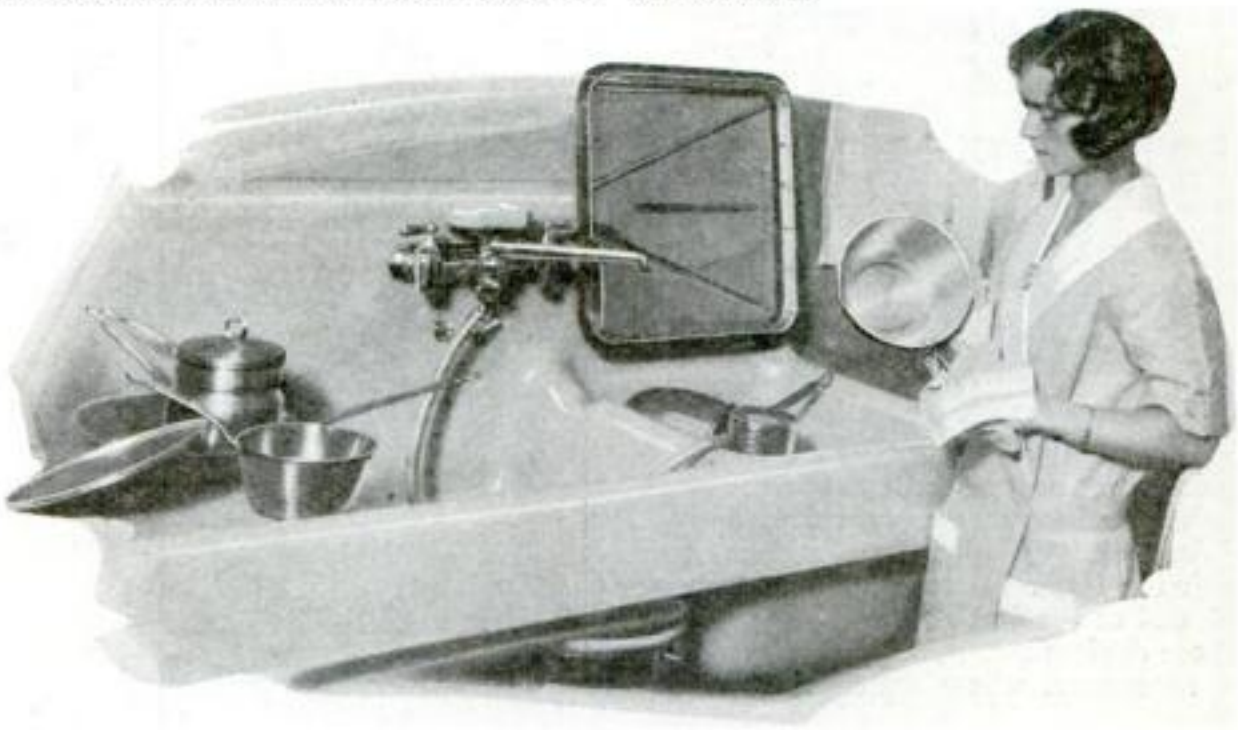
When a workman chanced upon it next morning, the knife was not in the least tarnished by its exposure.

Thus was discovered the first "stainless steel," which is now familiar to every housewife.

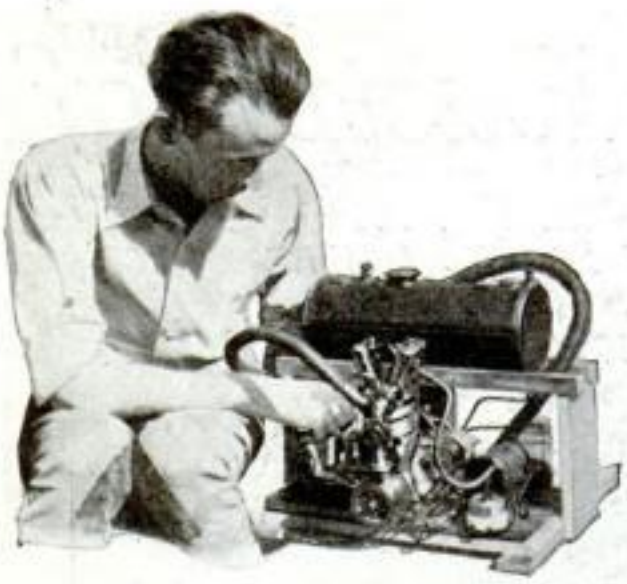
IT REMAINED for Dr. Benno Strauss, of the famous Krupp works at Essen, Germany, to find the new "super-stainless steel." He put half again as much chromium as Brearley used, plus some nickel, into his alloy.

The new alloy cannot be machined like ordinary steel, and a special process of manufacture had to be devised on account of its toughness. A magnet does not attract it. Because it does not affect compasses, airplane instrument boards can be made of it. Ordinarily red jeweler's rouge cannot be used to polish it, and a special rouge of green chromic oxide is used.

Why doesn't it rust? Metallurgists explain that the new alloy is no longer simply a mixture of the three metals of which it is made. They actually dissolve into each other in a solid state, creating an absolutely new metal with properties all its own.



Kitchen ware is now being made of the new super-stainless steel since it has been found that it resists all food acids, and no matter to what it is exposed it remains bright and shiny.



TINY HOMEMADE MOTOR RUNS 13-FOOT CANOE

NEARLY small enough to be carried, unmounted, in an overcoat pocket is a tiny gasoline motor that H. T. M. Rice, of Los Angeles, Calif., built for his thirteen-foot canoe. Yet the miniature engine motor propels the craft, with three persons in it, at six and a half miles an hour.

According to Rice it consumes one-sixteenth of a gallon of gasoline in an hour. Dry cells furnish the electric current for ignition. Although the diminutive cylinder has a capacity of less than four cubic inches, the motor has such refinements as a pressure oil feed and two oil pumps, a sixteen-jet float valve barrel throttle carburetor, and a drilled crank shaft.

VISIBLE CLOCK TIMES FOOTBALL GAME

SPECTATORS at British football matches will be kept fully informed of the passage of time by a huge timing device recently perfected. A large hand traverses the face of a dial and marks off the minutes as they are played. The dial is divided into a forty-five-minute section, with a thirty-minute section for overtime, to correspond with time allowances for British football.

Another innovation used in connection with the timer is a siren that will mark the end of the first half and of the game. These devices will be a great convenience to spectators, whose watches are rarely synchronized with those of officials timing the game and who thus must guess at the amount of playing time remaining.

MACHINE SOLVES HARD PROBLEMS

Intricate problems in higher mathematics are instantly solved by this new machine.

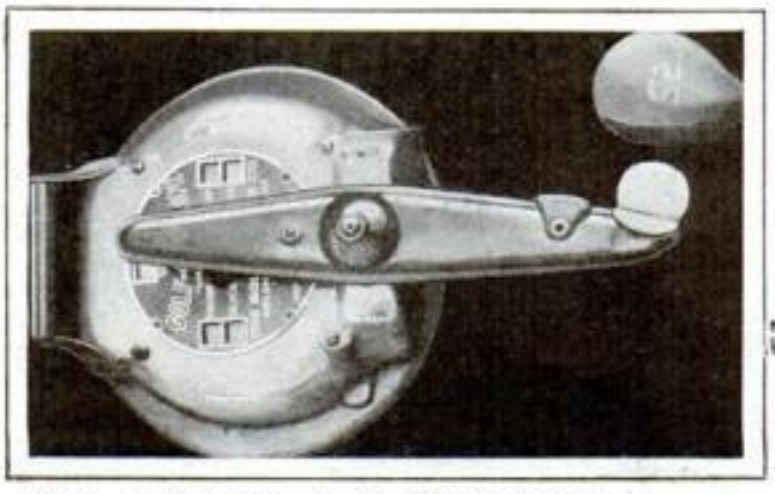
A "MECHANICAL Einstein," the brains of which are a set of electric relays, helps engineers of the Westinghouse Electric and Manufacturing Company solve problems that would require days or weeks of figuring with pencil and paper.

The device resembles a giant telephone switchboard. When an engineer desires the solution of a complicated equation, he simply plugs in certain wires and turns proper knobs. It will reveal all the "unknown quantities" of power transmission systems.

WOMAN GOES 700 FEET IN MAKING APRON

IN RECENT tests made at Cornell University, Ithaca, New York, it was found that a housewife walked seven hundred feet while making an apron. A woman unreeled a ball of thread as she assembled and put away material used in making the apron. Length of thread showed how far she walked in doing her task.

Further experiments showed that all but sixty-one feet of this distance could be eliminated by putting a "sewing center" in the form of a cabinet in the home.



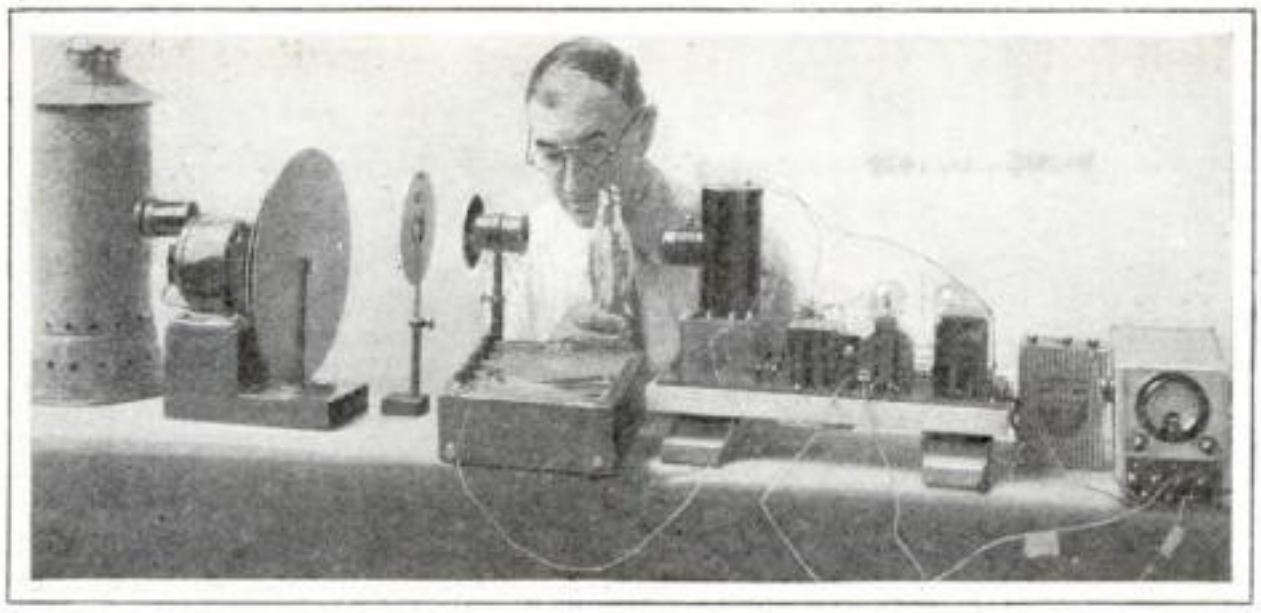
Above, a front view of the circular base to which a swinging arm is attached, holding a golf ball. At right, the device rests on the floor in position for a practice swing by golfer.

ARM HOLDS GOLF BALL FOR INDOOR PRACTICE

GOLFERS who fear a slump in their games during the winter layoff will be interested in an indoor training device recently developed in Indianapolis. It consists of a circular base to which a swinging arm is pivoted. A golf ball is attached to the outer or free end of this.

When the ball is struck by a club the arm rotates on its pivot. An indicator on the base then registers the length of drive or whether the ball has been hooked, topped, or sliced. The entire apparatus weighs but seventeen pounds and is secured firmly to the floor, without being fastened, by means of a rubber pad.

Golfing enthusiasts may use this device for playing indoor matches, scores being kept on a basis of the yardage of drives.



ELECTRIC EYE FINDS FLAW IN BOTTLE

IF THERE is a flaw in a "pop" bottle, a beam of light spots it in a new "electric inspector." The device was invented by a St. Louis, Mo., engineer to check the output of bottle factories and reveal any laxity in methods of manufacture. When a weak spot is found in a sample bottle, a needle jumps on a telltale electric meter.

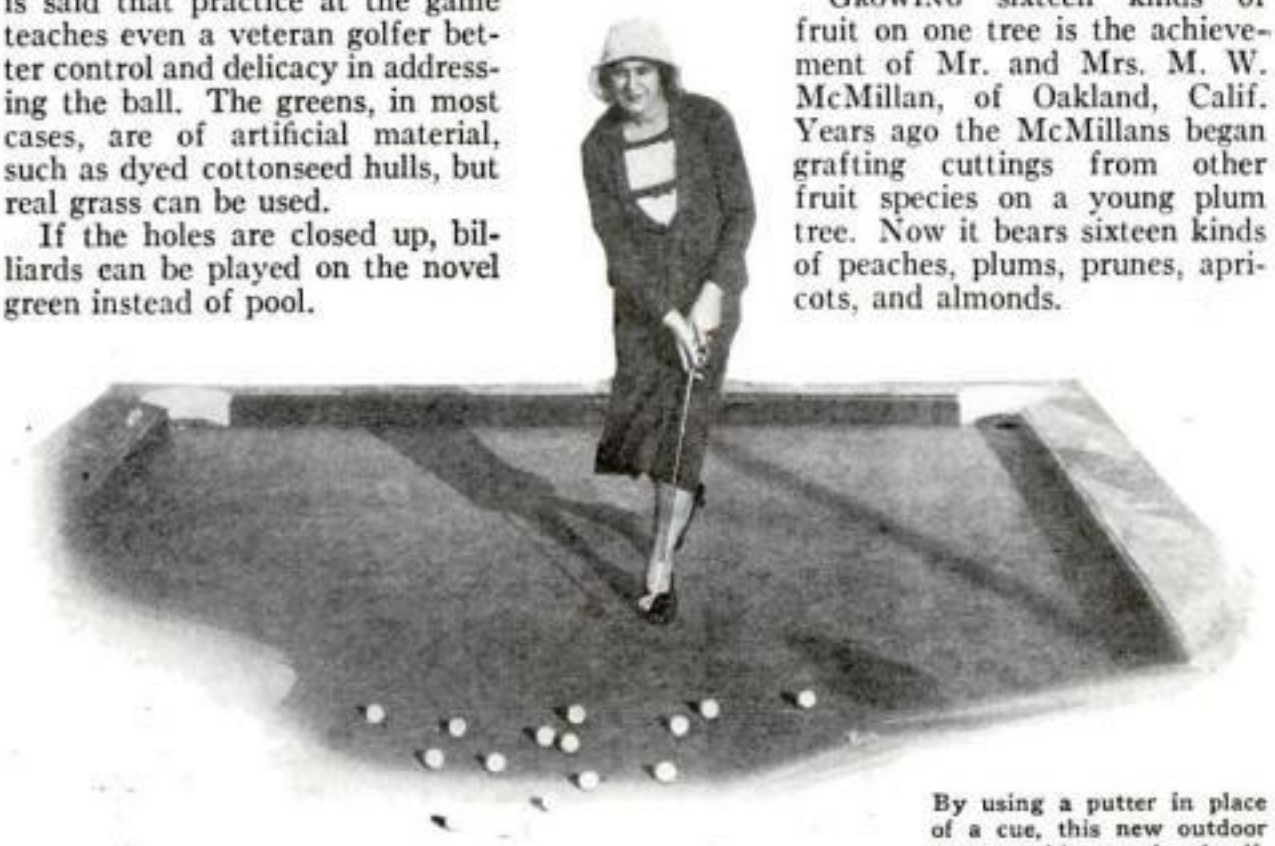
Light shines on the bottle from an electric lamp, at the left of the photo above. The beam is interrupted by a whirling perforated disk. After passing through the bottle, it is picked up by an "electric eye" and the resulting pulsating current can be amplified to give a reading on the meter. Any strained or weak spot in the bottle allows more light to pass, and causes a jump in the voltage which is registered by the meter.

GOLF JOINED TO POOL IN NEW OUTDOOR GAME

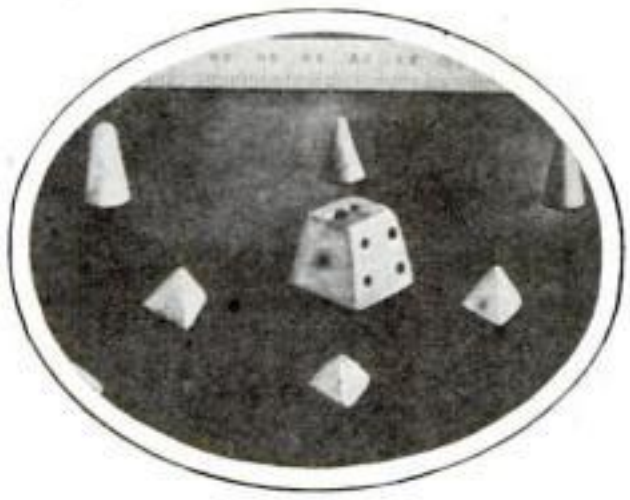
PUTTING on a golf green like a pool table top is a new variation of the popular pastime of miniature golf. "Pool golf," as the game is called, requires the combined skill of the golfer and the pool player. The game is played like pool, except that golf balls and clubs are used.

Experts at "holing out" on the green find a new problem in executing two- and three-cushion shots with a golf club. It is said that practice at the game teaches even a veteran golfer better control and delicacy in addressing the ball. The greens, in most cases, are of artificial material, such as dyed cottonseed hulls, but real grass can be used.

If the holes are closed up, billiards can be played on the novel green instead of pool.



By using a putter in place of a cue, this new outdoor game combines pool and golf.



DICE OF 3,500 YEARS AGO FOUND IN ANCIENT RUIN

THROWING dice had an earlier origin than most modern players imagine. Dr. Melvin Grove Kyle, of the American School of Oriental Research, found in the ruins of an ancient city near Hebron, in Palestine, pieces for an Egyptian game estimated to be 3,500 years old. Besides five pyramids and cones, evidently "men" for an ancient ancestor of backgammon, the set included an ivory die surprisingly like those used today. The dice were not "thrown," however, but whirled with a handle inserted in the top.

SIXTEEN KINDS OF FRUIT GROW ON ONE TREE

GROWING sixteen kinds of fruit on one tree is the achievement of Mr. and Mrs. M. W. McMillan, of Oakland, Calif. Years ago the McMillans began grafting cuttings from other fruit species on a young plum tree. Now it bears sixteen kinds of peaches, plums, prunes, apricots, and almonds.

HINGED HANDLE MAKES PARASOL ADJUSTABLE

With a hinged handle, this parasol can be carried easily at any desired angle.

A HINGE in the handle of a new parasol allows the user to adjust it to suit her fancy. It may be tilted to any angle to shield one from the sun's rays. When not in use, the shade folds into a compact bundle and slips within the hollow base of its own handle for carrying.

NEW DISTANCE FINDER DESIGNED FOR CAMERA

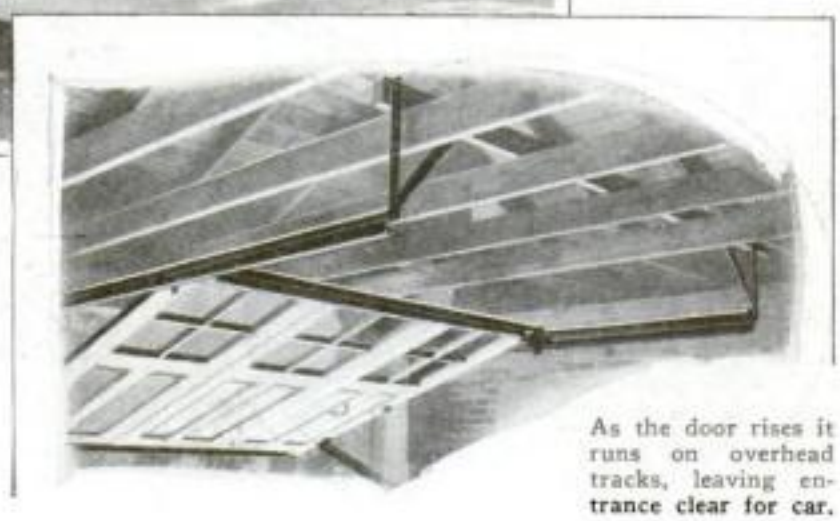
A NEW "gravity range finder" that clips to the camera bed eliminates guesswork in judging the distance.

The user tilts the camera downward until the feet of the subject are squarely centered in a small prismatic "finder." Automatically a small weighted disk, bearing numbers, turns by gravity to indicate the exact distance in feet.

Its inventor, Abraham Kurnick, of Brooklyn, N. Y., applied in it the elementary principle that the distance to an object has a mathematical relation to the height of the observer and the angle of sight to its base.

COIL SPRINGS WORK THIS GARAGE DOOR

This garage door is lifted out of the way by coil springs when touch of handle releases catch.



As the door rises it runs on overhead tracks, leaving entrance clear for car.

A CHILD or woman can quickly and easily open a garage door equipped with new fittings that allow it to swing overhead instead of folding to the side. The equipment may be applied to almost any type of garage or warehouse door. The door rolls on metal tracks, and a set of two heavy coil springs supplies power for its operation.

A gentle tug on a pull handle will open the door from the outside, and it automatically comes to rest in the raised position. A light pressure of the foot against the door itself opens it from inside the garage.

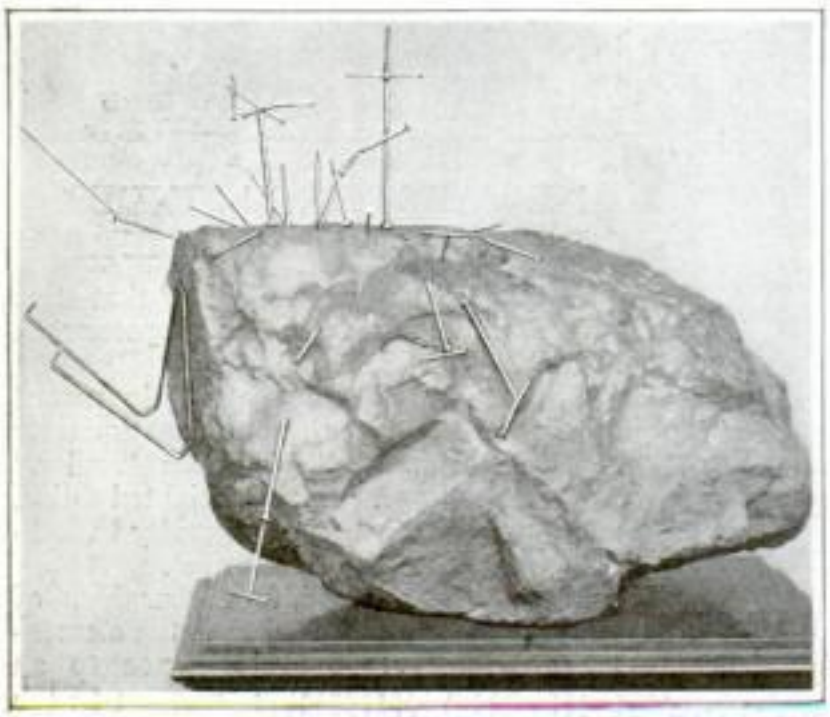
Doors so fitted do not require as much space for their operation as do the ordinary type of swinging doors. They can be worked even though the car has been placed so that its rear bumper is against them when they are closed. When raised they give a clear opening between the frames.

The pictures show these fittings applied to garage doors that formerly worked on standard vertical hinges. There are no parts of this equipment exposed to the weather except the lock face and the pull handle.

No electric motors, belts, or counterweights are required with this apparatus. It requires but three seconds to open or close a door fitted with it.

POWERFUL LODESTONE FROM UTAH

A PIECE of lodestone weighing more than four hundred pounds and possessing unusually powerful magnetic strength has been placed on exhibition at the Field Museum of Natural History in Chicago. This large magnet was found in Utah.



This lodestone, weighing 400 pounds, is part of one found in Utah. Because of its power, it was sent to a Chicago museum.

Some idea of its properties may be had from the picture. Large nails stand out from it at all angles, supported only by its power of attraction. The piece of string fastened to a nailhead holds the nail so that it stands away from its point of contact in almost a perfect horizontal line.

Lodestone is a variety of iron ore that will attract and magnetize steel. Ancient mariners stroked needles of steel with pieces of lodestone and obtained the first crude compasses. Though discovery of the mineral is lost in antiquity, one fable attributes it to a Cretan shepherd who, walking over a deposit, noticed that his iron-pegged sandals clung to the earth. Today lodestone, or magnetite, its scientific name, is an important source of iron, and there are many magnetite mines in the eastern part of the United States. Pure, magnetite contains seventy percent of metallic iron.

CHARCOAL FILTER ENDS MANY PIPE WORRIES

A PIPE that is intended to do away with some of the objectionable features of pipe smoking has been developed by a Seattle, Wash., inventor. It contains a filter in the form of a small cylinder under the bowl. Filled with chemically treated charcoal, it condenses the moisture that might be drawn through the stem and catches tar and ash. It also eliminates the taste of burned varnish in a new pipe. Cleaners are unnecessary, as the filter is easily replaced by a new one when clogged, and new filters cost only a few cents.

ARMY TRUCKS TAKE MEN OVER LONGEST BRIDGE

WHAT once would have been a transport job for the Army and Navy combined was accomplished recently in a few minutes when an Army regiment crossed the James River, Virginia, at a point where it was four and one half miles wide.

Instead of proceeding on foot, the unit was mobilized in a fleet of sixty-five motor trucks. Thirty of the trucks carried baby tanks. The long line swung across the longest highway bridge in the world, which spans the river near the scene of the famous Civil War battle between the *Monitor* and the *Merrimac*.

Remarkable photo of longest highway bridge shows 65 Army trucks carrying men across.

BIGGEST TRUCK HOLDS 100 TONS

So LONG is a new British truck, called the world's largest, that an assistant who rides in a cab at the rear converses with the driver by telephone. At the assistant's bidding, the driver pulls over to the side of a narrow road to allow other vehicles to pass.

While a five-ton truck is a common sight on any road, the British leviathan can handle a load of 100 tons. If necessary, it could haul a small locomotive across country. It was designed especially for carrying boilers and other large pieces of machinery. Because of its size a special permit had to be obtained to allow it to use the roads, and even then it is permitted to travel only at night when traffic is light.

The truck's enormous weight is distributed upon ten wheels. Warning and information are combined in a sign at the back for the benefit of approaching motorists: "You are behind the world's largest lorry. Please drive with caution."

The photograph at the right shows the truck loaded with a large boiler which it carried from Liverpool to Dorking, near London.

Above, the mammoth 100-ton truck loaded with boiler and the driver guided by phone.

NEW NEON TUBE LIGHT DEVELOPED FOR HOME

LIGHTS of the luminous-tube type used in advertising signs are now to appear in the home. They can be furnished to give a soft light, may be used in ordinary lamp sockets, and will run on standard house current. They need no transformer of any kind and use little current.

Raymond R. Machlett, New York City, with the neon tube he has developed for lighting homes.

RUN BIG X-RAY TUBE AT 600,000 VOLTS

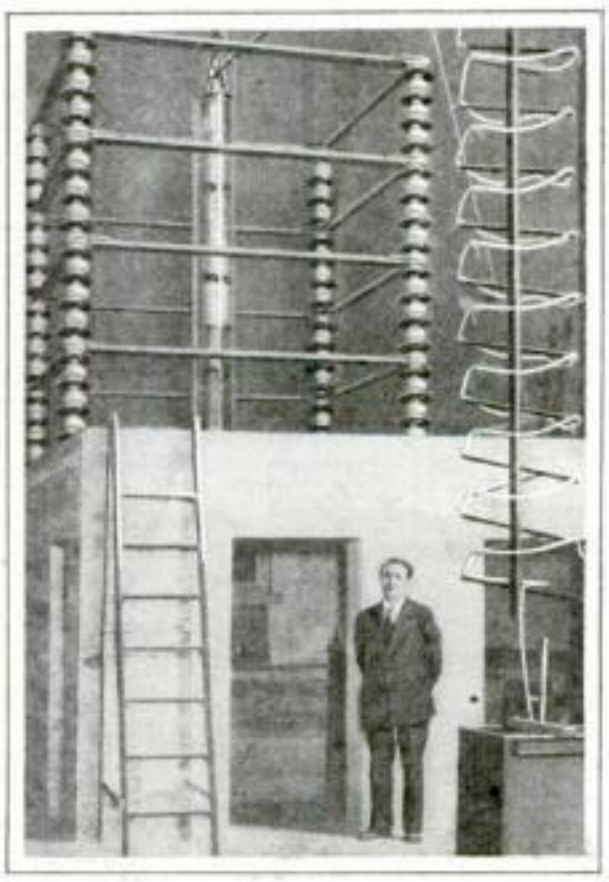
FOR YEARS physicists have struggled to obtain an X-ray tube whose rays would have a curative power equal to that of radium. Not long ago Dr. Rollin H. Stevens, of the Radiological Research Institute, summed up the progress:

"We now produce X-rays at from 6,000 to 250,000 volts. If we went to 300,000 or 400,000 volts, we could get practically radium rays from an X-ray tube. But we cannot go that high, for we lack the tubes to stand it."

The other day, California Institute of Technology engineers exhibited their answer—a gigantic X-ray tube thirteen feet long and a foot thick. It can operate at 600,000 volts. At that power, its rays are said to be nearly as powerful as those of all the radium used in the United States put together.

The tube has been under construction, experimentally, for three years. It was recently rebuilt by its designer, Dr. C. C. Lauritsen, to allow close-range observation. Its mighty rays pierce two inches of lead or more than two feet of concrete. It has not yet been tried on living creatures.

The tube was made by fusing together, end to end, several glass tanks similar to those seen at gasoline filling stations. This is not the world's largest tube but it has greater power to produce a highly concentrated beam.



The giant tube can be seen at upper left, rising from concrete blockhouse and insulated cage.

ROLLER SKIING NEW SUMMER SPORT

SKIING on dry land, all the year 'round, is now possible with the recent invention of "roller skis." Similar to roller skates, they are equipped with small wheels.

If a skiing enthusiast is impatient for the arrival of winter snows, he can don the skilike footgear and go poling along a street or sidewalk. A coast down a paved incline, it is said, gives all the thrills of the winter sport.

LIGHTS PLAY A TUNE

A NOVELTY in electric signs, recently installed in Harrison, N. J., is an advertising beacon with a theme song. Lighted notes on its 150-foot face jump from line to line of a staff to indicate a tune.

Use Five Farms as Big Laboratory to Watch Electricity at Work

AGRICULTURAL interests of twenty-four states have united in an effort to find out just what can be done with electricity on the farms of this country. At present the experiments are being made on five average farms in Maryland under the direction of the University of Maryland. On them electricity is being used for almost everything, from killing flies to turning on an alarm clock to wake the hens to a busy day of laying. When flies light on a screen through which a current is passing, sparks leap out and electrocute them.

At a certain hour in the morning an alarm clock goes off in the henhouse and an electric heater starts warming water for the hens. Pressing a button near the farmer's bed turns on floodlights that bring the brilliance of day to the nighttime.

Electrically powered machines milk the cows, polish the plowshares, wash the dishes, sweep the floor, heat hotbeds, cool the refrigerators, and cook the food. Electricity runs sewing machines, bread and cake mixers, and washing and ironing machines.

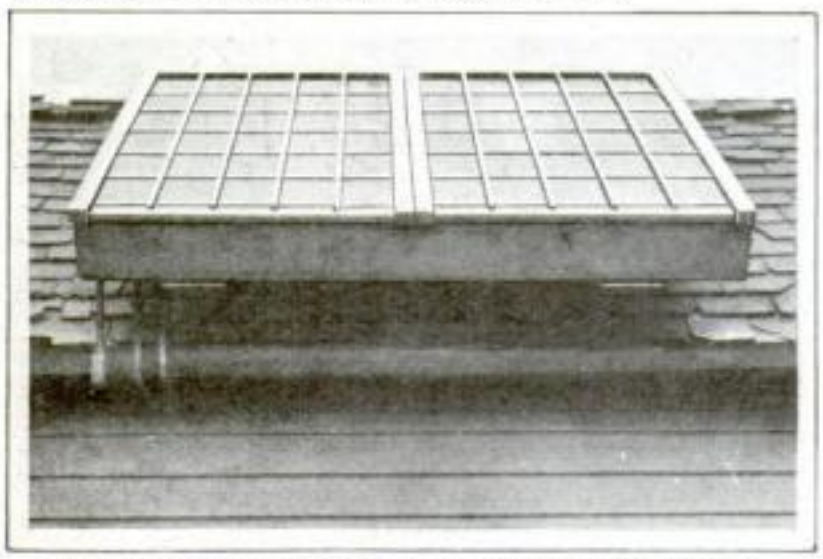
With these mechanical aides, the farmer's wife is able to do her work in half the time with less than half the effort required under the old system.

Those in charge of the experimental farms found that electric current for refrigeration cost about one fourth as much as ice for the same purpose. Similarly, twenty-five cows were milked for forty days at a cost of $30 for current. The sponsors of the new movement say that economy and efficiency are combined when electricity goes to the farm.

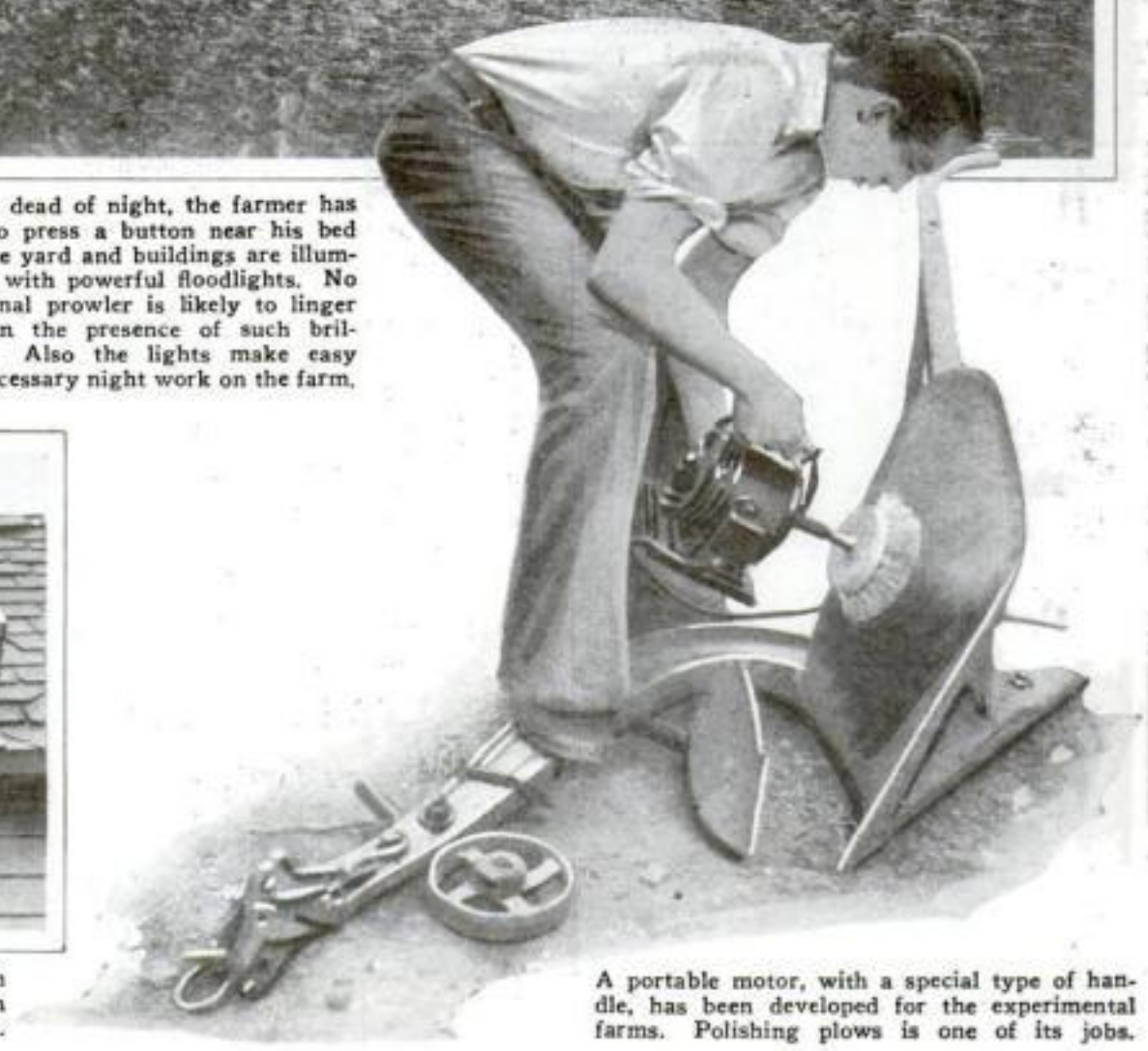
A quarter-horsepower motor runs this corn shelling machine which rapidly strips the kernels from the cob. This is only one of the many electrical appliances now being used in the experiments with electricity on the farm.

Flies and other insects have absolutely no chance to get through this electrically charged wire screen. The instant they touch it they set up a short circuit and sparks leap out and kill them.

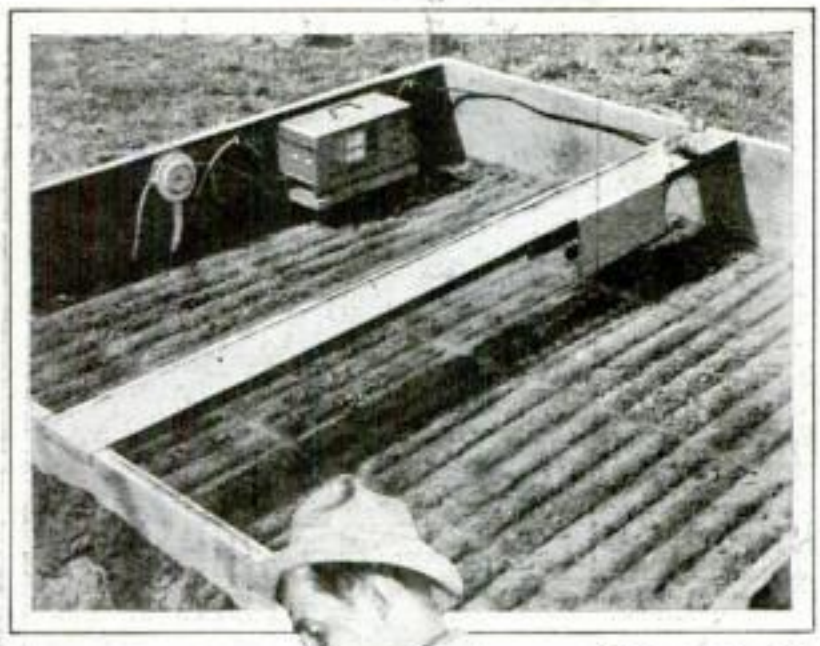
In the dead of night, the farmer has only to press a button near his bed and the yard and buildings are illuminated with powerful floodlights. No nocturnal prowler is likely to linger long in the presence of such brilliance. Also the lights make easy any necessary night work on the farm.



There is no charge for fuel to run this solar heater which on summer days heats water to 150 degrees. A motor-driven pump circulates the water and a thermostat controls it.

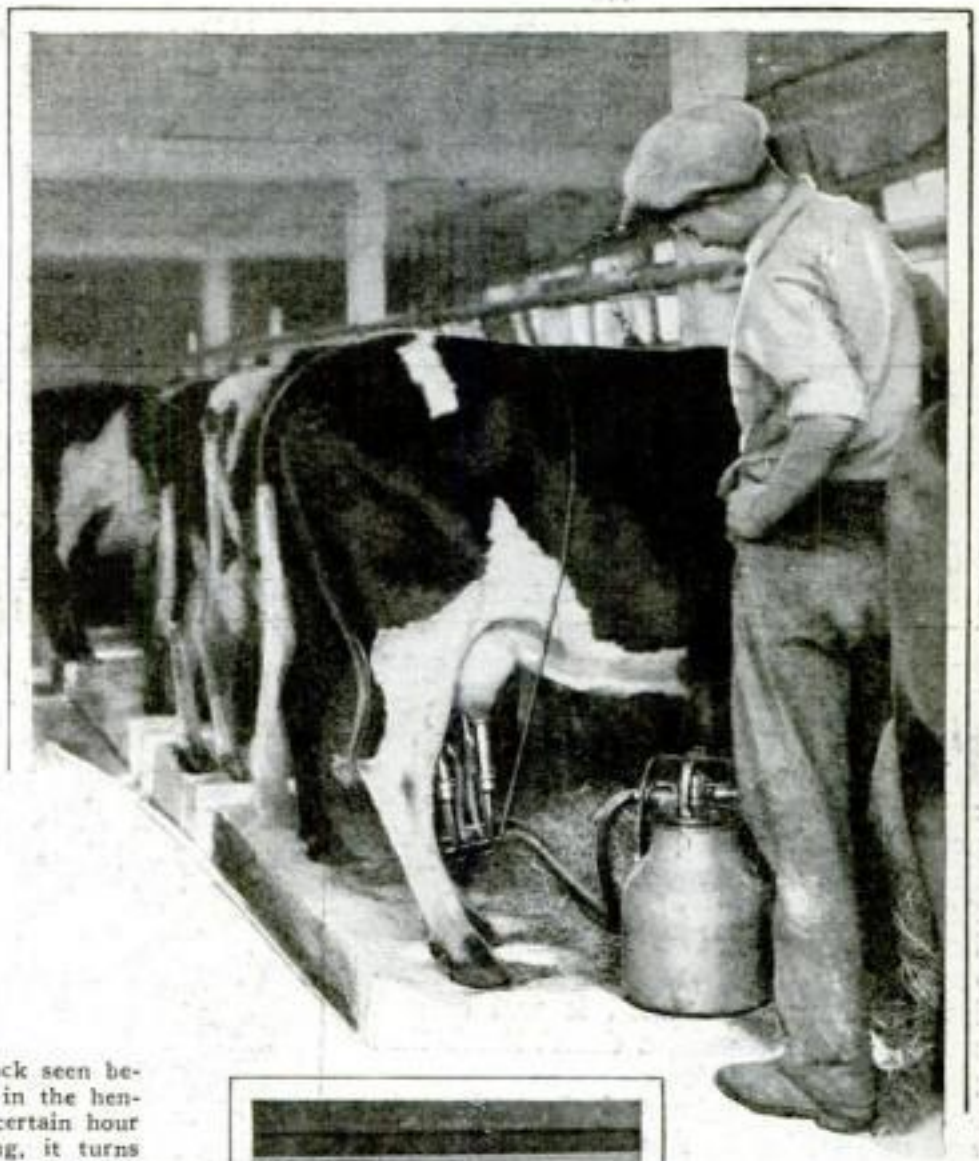


A portable motor, with a special type of handle, has been developed for the experimental farms. Polishing plows is one of its jobs.



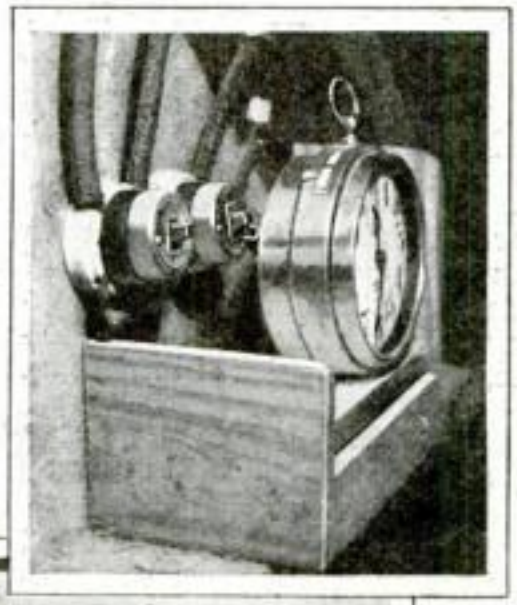
Work on the Maryland farms shows that growth can be forced in hot-beds, like the one above, when they are heated by electricity. In the bed shown here, the heating elements are buried beneath the soil.

The work to which electricity can be put on the farm is limited only by the number of jobs to be done. At right, an electric bulb is being used to test incubating eggs. This tester is accurate and far faster than any other method.



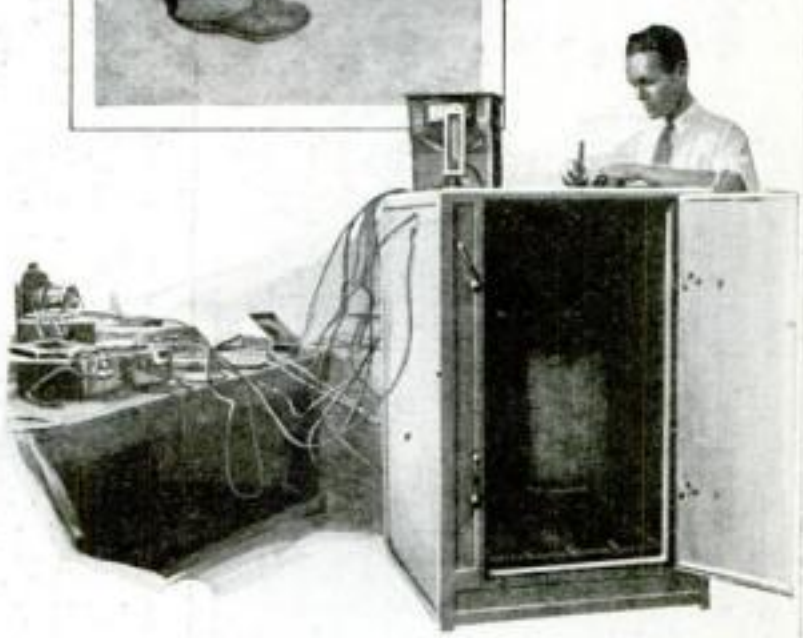
Above, an electric milker is seen in operation. A machine of this kind will milk twenty-five cows a day at a cost of 75 cents for current. It does the work rapidly and when properly handled is found to be more highly sanitary than milking done by hand.

The alarm clock seen below is placed in the henhouse. At a certain hour in the morning, it turns on bright lights that waken the hens and fools them into thinking day has come. Experiments show that hens, thus awakened, will lay more eggs.



Turning by hand the thousands of eggs in a big incubator is no small job. However, the work is done easily in an electric apparatus. At left is one of these, in which 6,912 eggs are turned in five minutes.

When hens are wakened in the cold gray dawn, the first thing they want is a drink. So this electric heater automatically turns on and quickly heats water for them.



A new electric sterilizer has been developed for the experimental farms. The picture shows such a machine being tested. Dry heat is used and it has been found that utensils thus treated are free of bacteria. The device is wholly automatic.

NOW MAKE RUBBER FROM WILD MEXICAN SHRUB

WHILE Thomas A. Edison and others are seeking in the East a weed that will produce rubber in quantity, experiments in the West have gone forward so successfully that a $150,000 factory is now being built near Salinas, Calif. Through a process discovered by Dr. William B. McCallum, California botanist, it will extract rubber from guayule, a desert shrub that grows wild in Mexico.

A smaller, experimental plant, the only one of its kind in America, has been in operation for several years at Salinas. It has produced and shipped several thousand pounds of rubber a week.

The new plant will cultivate the guayule shrub on a 25,000-acre tract. Instead of yielding sap, or latex, like rubber trees, the shrubs contain a rubber-producing gum in the cells of their bark and roots. They are therefore uprooted, washed, and crushed to extract the rubber when their four-year period of maturity is reached. Through the use of modern machinery, the process can compete with imported rubber, and some authorities foresee that 130,000 square miles of desert in California, Arizona, New Mexico, and Texas may be put to work raising guayule. The nurture of the shrub is essential as otherwise the rubber is not stored in the stalks.

A shrub, once growing wild on the Mexican deserts, is now cultivated, as at left, and rubber taken from it. Above, the growing plant and a slab of rubber.

ENGINE RUNS 66 YEARS

WHAT is considered to be the oldest passenger locomotive still in active service maintains a regular run on the Isle of Wight, England. This engine, in its sixty-six years of existence, has traveled 1,500,000 miles, and gives no sign of breakdown.

NORTHERN LIGHTS, MADE BY MAN, GUIDE FLYERS

A MAN-MADE aurora borealis recently flashed in the Hollywood, Calif., sky, when 332 merchants of that city's main thoroughfare pooled their resources to produce an illuminated pageant.

Airplanes passing on scheduled routes were guided from afar by the shimmering beacons that illuminated the sky. A concentration of powerful searchlights in a fan-shaped display produced a glorious spectacle of light that was visible for miles. A photographer managed to preserve some of its fleeting beauty in the remarkable photograph on this page. From the sky the glare was easily visible for many miles, throwing out the streamers characteristic of northern lights.

BAD PARK BEARS GET TAKEN FOR A RIDE

UNRULY bears are taken for a ride at the Yosemite National Park. If Bruin becomes troublesome, a novel "patrol wagon" appears, in the shape of a large section of corrugated pipe sealed at one end and fitted with a trapdoor.

A park attendant detaches the pipe from its wheels and lures the bear inside with a piece of meat. The trapdoor makes him a speedy prisoner.

Under orders of the park superintendent, who invented the device, the sentence for any bear causing trouble in an inhabited portion of the park is banishment. A daub of paint identifies the miscreant in his disgrace.

When bears fail to behave themselves in the Yosemite National Park, a keeper takes them for a ride in patrol wagon.

NEW HANDLE WORKS CAR BRAKE

This handle on auto emergency brake supplies leverage that makes operation easy.

WOMEN drivers, in particular, will find a new emergency brake handle a convenience because of the leverage it gives them on the brake button. This movable handle, hinged at right angles to the car's emergency brake lever, extends over the locking button on the lever.

Pressing down on the handle releases the catch and the lever is pushed forward or pulled back as required.

The device is applied to the car's standard brake lever by means of two bolts. No machining or drilling is necessary in attaching it. It is also more convenient to the steering wheel than the brake levers fitted in some cars and can be reached without stretching.

PHONOGRAPH RECORDS RADIO PROGRAM

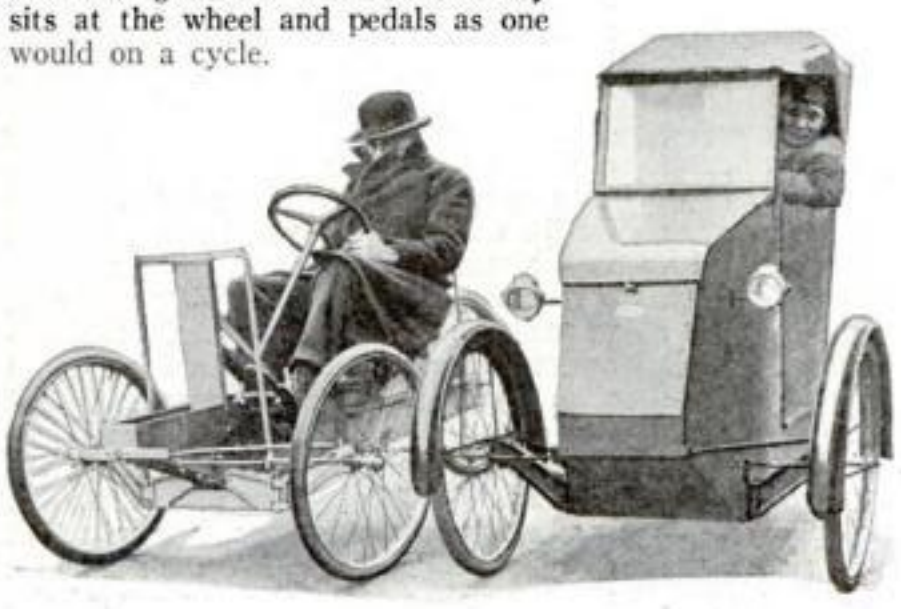
YOU can make a phonographic record of your own voice or record your favorite radio program through an attachment on a new combination radio and phonograph. The attachment does not interfere with the ordinary use of the instrument for playing a record or program.

For record making, a microphone picks up voices and transmits them to a blank record through an electric "pick-up" similar to the reproducing arm of a standard electrified phonograph.

MIDGET CAR HAS TOP— USES MAN POWER

A FLIVVER car that needs no gasoline has made its appearance in Europe. This man-power automobile also does without a license or a garage.

Its chassis resembles a large tricycle, and it is equipped with a propelli ; apparatus like that of an ordinary bicycle. The body is complete with top, windshield, and headlights. To "drive" one merely sits at the wheel and pedals as one would on a cycle.



This three-wheeled car has top and windshield but no engine, and is driven by pedals like a bicycle. No license is needed to operate it.

From this room New York traffic lights are controlled. Once set, they work automatically. At left, diagram shows location of the lights.

AUTOMATIC LIGHTS RUN NEW YORK TRAFFIC

SPEEDING up New York's motor traffic was recently accomplished by a modification of the "progressive" system of traffic control, by means of which cars may pass through the streets at a fixed rate of speed without being stopped by traffic lights.

This method of traffic control, in which green lights flash successively down the street, was used wherever straight streets and blocks of equal length permitted it, and traffic lights elsewhere were "staggered" or adjusted to work in harmony with them.

The enormous task of coördinating this system of lights for America's largest city was accomplished by erecting a central control room. The boxes, seen in the picture, regulate traffic lights on a given number of streets by means of adjustable timers. A telltale light over each box shows how its lights are operating.

Every traffic light on Manhattan Island can be adjusted to any interval of operation from this room, but once adjusted their operation is automatic. The attendant, shown on duty, merely stands by in case of emergency. A three-wire circuit works the lights. There is one positive wire for red lights, one for green, and a negative wire to complete the circuit.

Almost any combination of traffic light timing may be effected at almost a moment's notice.

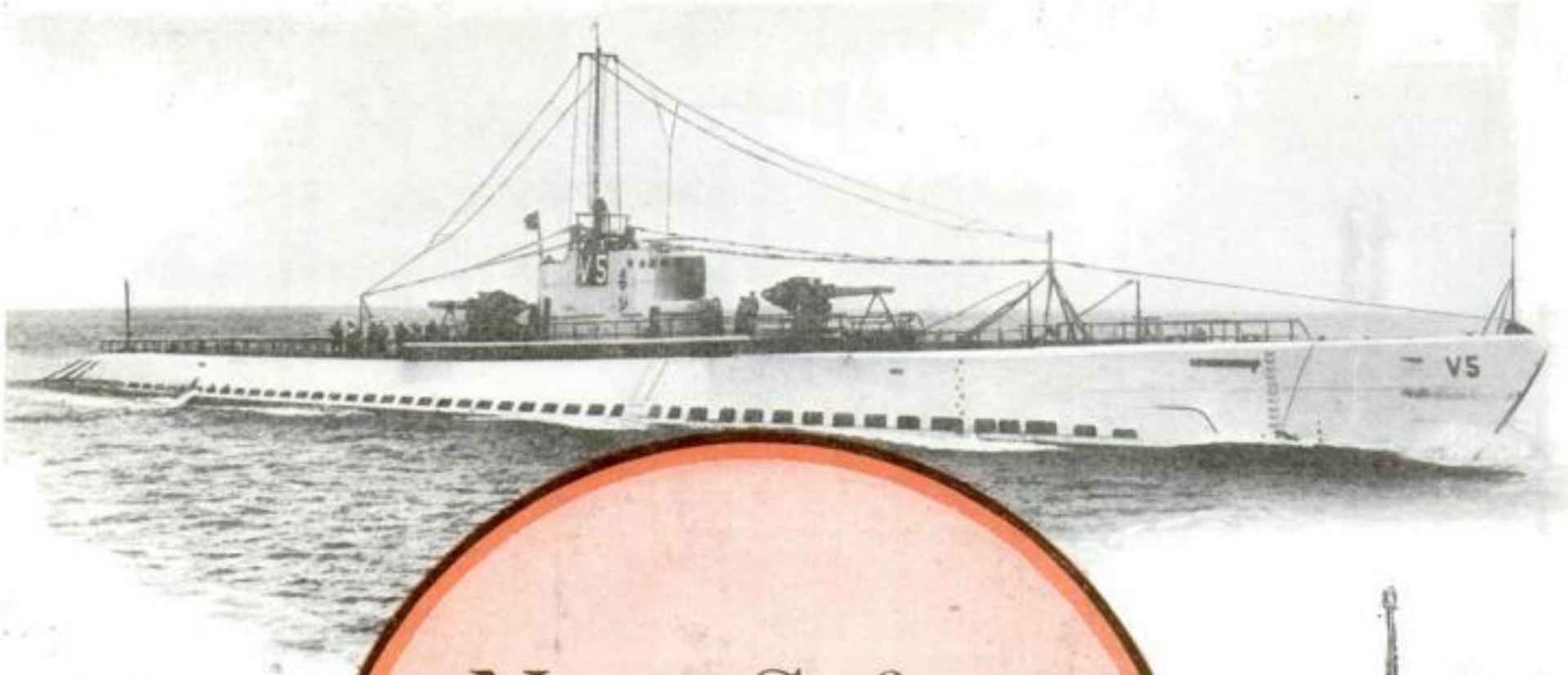
BODY OF RUBBER AIDS STUDENTS

A LIFE-SIZE rubber model of the human figure, complete in every detail from the skeleton outward, has just been finished by Dr. Loyal Clark, of Portland, Ore. It is to be used for the instruction of medical students.

Flaps in its surface may be raised, permitting the student to see each bone, muscle, and organ in true relation to its surroundings. Various sections may be removed entirely or taken apart for study.

Use of this model, it is believed, will be of great assistance in the instruction of medical and dental students. Five years of research work were required to complete this model, the first of its kind ever made. The flexibility of the rubber simulates human tissue.

A real rubber man, complete in every organ and bone, has been made for medical students.



The new *V-5*, America's latest submarine, is 371 feet long and carries a crew of eighty-seven officers and men. It is said to be the safest undersea boat yet built.

New Safety Under the Sea

Mechanical Aids Protect Lives of Men on Boat Beneath Waves—This First-Hand Story Tells You Exactly How a Submarine Is Now Run

By EDWIN W. TEALE

A CLANGING of sledges, a creaking of timbers, a loud swas-s-h, and the U. S. Navy's "safety submarine," the *V-5*, slid into the Atlantic recently at Portsmouth, N. H.

This steel-gray, block-and-a-half-long dreadnaught of the depths inaugurates a new era in submarine security. It can "go to sleep" for forty-eight hours on the ocean floor 200 feet below the waves and can travel a quarter way around the globe without refueling. Equipped with "artificial lungs," escape hatches, automatic steering gear, fume-proof battery compartments, and the latest scientific instruments, it is a $5,200,000 floating laboratory, putting to test the results of more than two year's research by Navy officials.

While this newest underwater boat headed along the New England coast on its maiden voyage, I had an opportunity to see how sailors are trained to handle these huge steel fish and to meet the perils that lie under the sea. I accompanied the crew of the *O-1*, sister ship to the boat Wilkins will use next year in explorations under the polar ice, on a submarine cruise off the naval base at New London, Conn.

Captain John M. Ocker, calm-voiced and broad-shouldered, led me across the gangplank to the tiny bridge, perched like a buoy a dozen feet above the water. I could see the rounded sides of the great steel hull curving down out of sight, black above the water line, green with fine sea moss below it.

The *O-1* is 172 feet in length, almost as long as Jules Verne's imaginary *Nautilus*, in which Captain Nemo sailed the seven seas. We slipped down the quiet Thames River to the choppy Long Island Sound.

Captain Ocker motioned to an electric horn at the right of the bridge. Two blasts of this horn, he told me, is the signal to submerge. A double sounding was selected because someone might accidentally blow it once, and if that were the signal, the sub would dive with its hatches open. Something almost as bad happened to the *S-20* once when Captain Ocker was aboard. With one of the hatches jammed half open, it dove into the Gulf of Mexico. A Niagara of water poured down into the control room.

"What happened?" I asked.

"We blew the tanks and came up quick. A few tons of water won't sink a submarine. More than that, the control room is at the center of the boat and the added water didn't upset its balance."

"Blowing the tanks" is the term for expelling the water in the ballast tanks with compressed air. Water is taken in to weight down the ship and make it sink. It is blown out to make the ship rise.

Another submarine, a few years ago, was not so lucky as the *S-20*. Off the Delaware Capes, it submerged with a valve wide open. Sixty tons of sea water flooded the engine compartment. The sub was diving at the time and the water rushed to the bow, pulling it down like the stone head on an arrow. It dove almost straight down, running its nose into the mud with the tip of the stern sticking out of the water, where its propellers were useless.

For more than twenty-four hours, the

helpless crew crouched in darkness within the steel hull, hoping against hope that help would come. They were off their course and knew the chances of rescue were slight. Finally they succeeded in cutting a small hole through a plate above the water line, and hoisted a white shirt on a piece of pipe.

That shirt and a miracle saved them. A merchant marine skipper, uncertain of his position, saw the flag above the small dark object and, thinking it a buoy that would give him his place on the chart, steamed close. He was amazed to see two propellers sticking up beside the "buoy," flashed a call for help to the Navy Department, and rescue ships arrived.

We passed the *O-2*, going back to the base, not far from Gardner's Island, the legendary hiding place of Captain Kidd's pirate gold. Near the Bartlett Reef Lightship, we came to the area in which we were to dive. In a matter of fact voice Captain Ocker said:

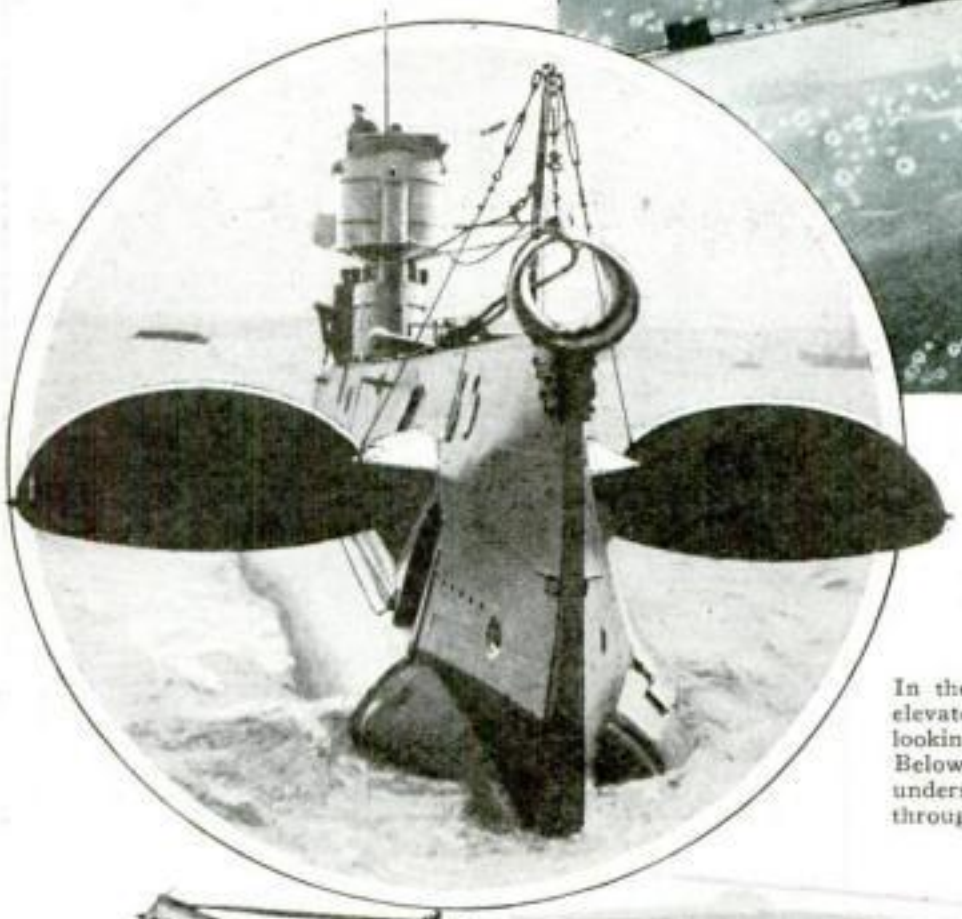
"We will now submerge."

The electric horn blared twice. Below there was the hollow clang of metal, the scurrying of feet. Nearly fifty valves, manifolds, and hatches must be secured before the boat can travel underwater. The lives of the entire crew depend upon the care and skill of each member. One minute and a half is the usual time required to prepare for a dive. The record is about forty seconds.

We climbed down the hatch. The purr of the Diesel engines ceased. Electric motors only are used underwater. If the oil-burners were run in a closed submarine they would suck out the air in less than a minute. As soon as the hatch cover banged into place below the bridge, I scrambled up a small steel ladder and squeezed into the conning tower, a chimney of steel ringed with portholes of heavy glass. Through them I could see the sunlight glinting on the waves, the buildings of New London crowding the distant Connecticut shore, and a dark smudge like smoke—the far tip of Long Island.

Below, everything grew suddenly silent in the hold. Captain Ocker's calm voice gave a command. There was a creak of levers, the hissing of compressed air. The water about the hull began to boil. It was milk-

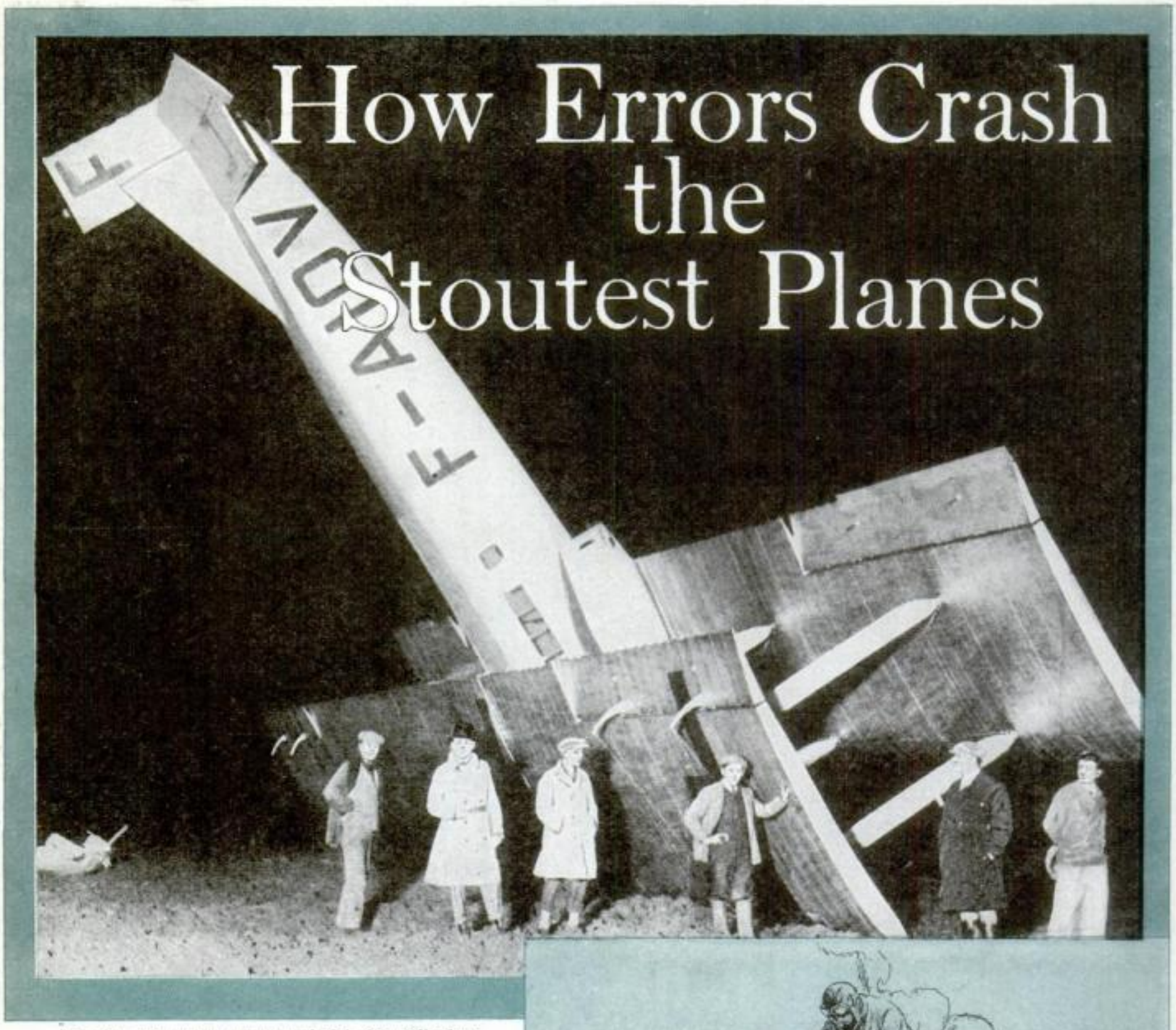
(Continued on page 148)



This drawing suggests what goes on aboard a submarine as it slips along under the waves. Note the captain at the periscope in which he sees boats on the surface of the sea.

In the circle, a sub, with its elevated planes extending, looking like some sea monster. Below, the bow of another undersea boat is breaking through the surface as it rises.

How Errors Crash the Stoutest Planes



The pilot and twelve passengers had a close call when this French plane, in forced landing, landed on nose.

Drawing from photograph of Capt. Macready's crash in Illinois. As shown, the plane was demolished, but the pilot escaped with only a broken nose.

Aircraft Built for Sane Flying Seldom Fail, but This Article Tells How Stunts Strain Ships and Cause Wrecks That Help Flyers

By H. C. DAVIS

IT IS the climax of the National Air Races at Chicago. Five wing-clipped planes jockey around a tiny triangular course at three miles a minute, racing for the Thompson Trophy.

Far in the lead, Capt. Arthur Page rides an 800-horsepower winged engine at 205 miles an hour. As he rounds the pylons, the terrific centrifugal force is driving the steel seat upon which he sits farther and farther into the fuselage.

Three laps to go. Page thunders around a turn with throttle wide open. The blue and gold racer streaks toward the crowded grand stand, packed with 75,000 people. Suddenly the bellow of its huge motor ends in a choking gasp. The heavy plane wavers in the air above the solid mass of humanity, its motor stopped.

Without hesitation, the pilot swings out toward the open field, taking the desperate chance of a downwind landing to save the crowd. The ship nears the ground, hangs unsteadily for a split second, then plunges nose-down, throwing up a cloud of dust like a bursting shell. One more name has been added to the list of those who have "gone west" by "crashing in."

Why is this list so long? Why do planes crash? In six out of ten cases, according to late statistics of the U. S. Department of Commerce, the answer is "pilot trouble." Errors in judgment or in handling the plane account for most bad crashes. Of course, there are cases, like that of Captain Page, when a flyer is caught in a tragic trap and the only way out is to take

a chance that violates a primary rule of flying.

Every fledgling pilot is taught to take off and land headed as nearly as possible into the wind. There is a sound reason for this.

It is the air flowing past the wing that gives it lift. An airplane depends upon speed through the air to keep it from falling. When the air ceases to flow past fast enough, the wings lose their sustaining power, the plane is said to have "stalled," and it falls. A flight is a constant battle between the weight of the machine pulling down and the lift of the wings pulling up.

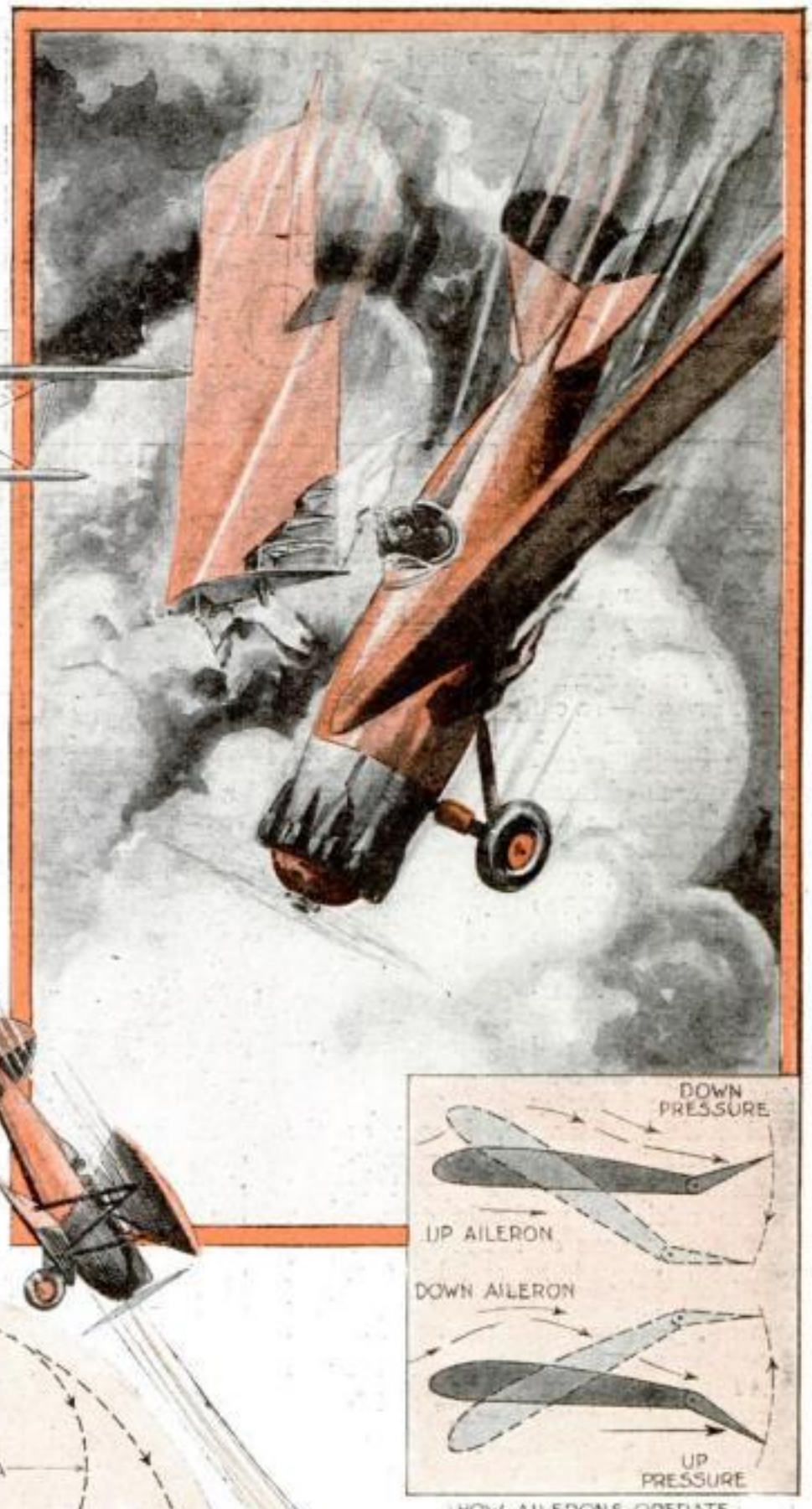
A simple illustration of how an airplane flies is found in a flat stone skipping across the surface of a pond. This is possible only when the stone is moving at high speed. The faster the stone is moving, the greater the resistance or "lift" offered to it by the water when it strikes the surface of the pond.

As long as this lift is greater than the weight of the stone, the latter continues skipping. But as the speed decreases, the "lift" decreases and a point is reached where the weight of the stone is greater than the lift and the stone sinks. The same thing happens to it as happens to an airplane when it stalls.

While the resistance of the air striking the underside of the wing supports the plane, just as the resistance of the water to the underside of the flat stone supports the stone, the cases are not exactly alike. The stone travels on top of the water while the airplane flys through the air.

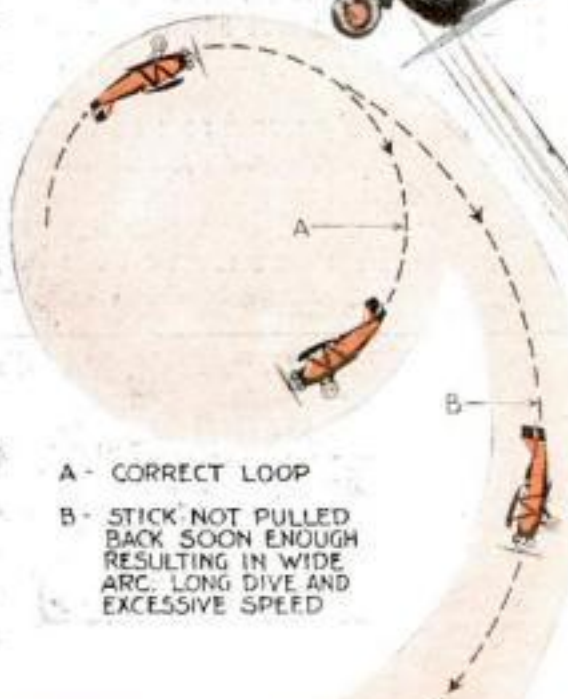
The top surface of the stone has no effect on the water. The top surface of the airplane has an effect on the air above it. Because of its curved shape, it causes a partial vacuum above the top surface. This amounts to the same thing as taking so much weight off the top of the wing and allows the pressure below to lift more effectively. In fact such a good vacuum is created by a properly curved wing that it triples the effective lifting power of the increased air pressure below the wing.

At right, drawing will give an idea of how a wing is torn off in a power dive when plane travels 250 miles an hour, throwing great strain on the brace wires.



HOW AILERONS OPERATE

Ailerons give plane sidewise balance by working against up and down currents that constantly hit craft.



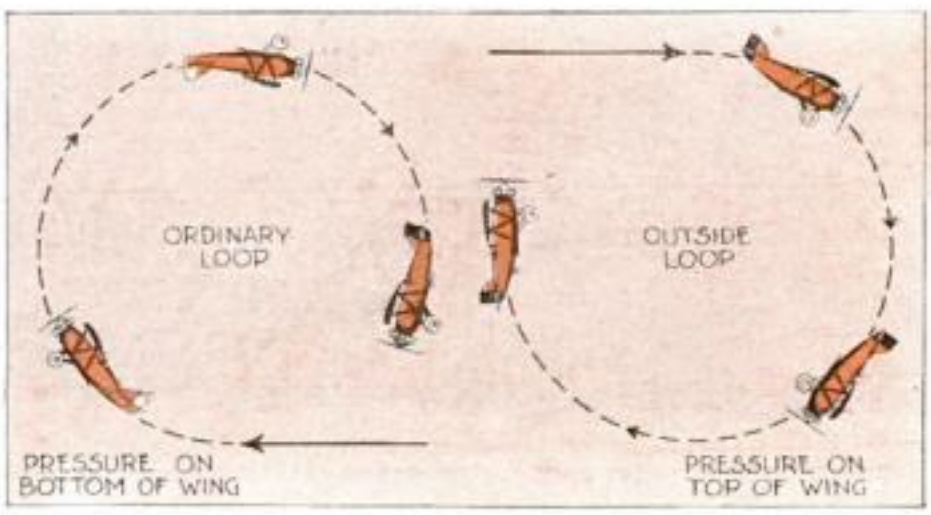
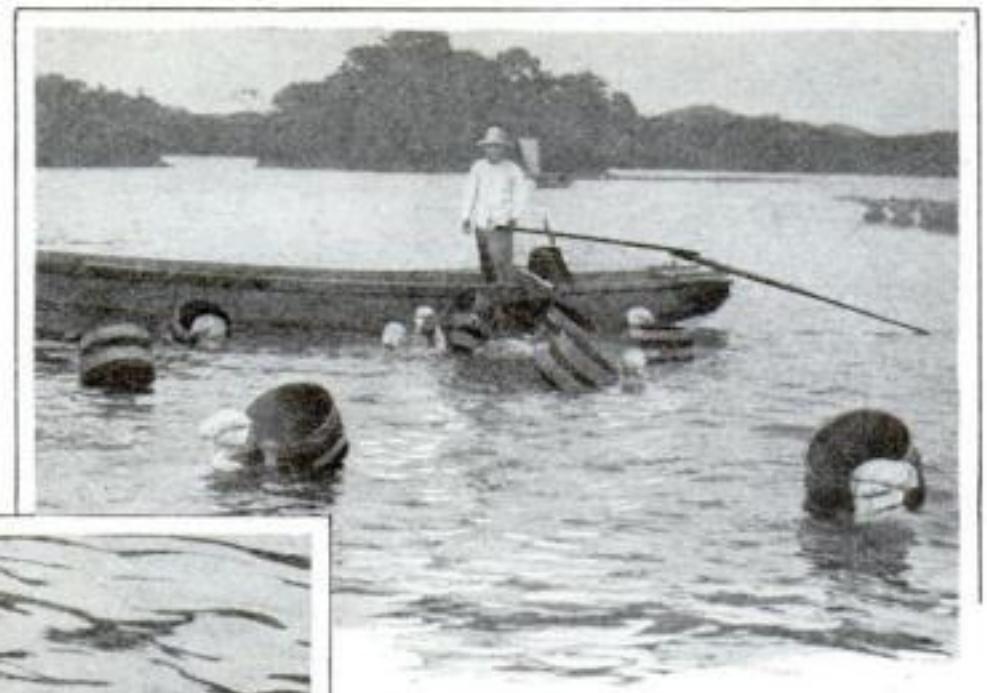


Diagram of stunts showing how great pressure is thrown on various parts of the machine in steep dives and loops and why bad control may end in a fatal crash.

Of course the lifting power of an airplane wing for each square foot of surface is relatively small as compared with normal atmospheric pressure, which is six hundred and thirty-seven pounds per square foot. The average airplane wing has a lift of about ten pounds for each square foot of area. This means that the actual air pressure on the bottom surface of the wing approximates 640 pounds and on the top 630 pounds per square foot.

Biplanes are only about eighty-five percent as effective as monoplanes per square foot of supporting surface because the upper wing *(Continued on page 155)*

Oyster Pearls, Worth Millions, Made to Order



Three times each year the pearl-growing oysters are raised in their cages and given a thorough cleaning.

New Japanese methods force gems to grow in caged bivalves—Plans being made to extend the industry to America.

By

EARL CHAPIN MAY

BY LEASING about 40,000 acres of warm salt water in various bays along the shores of Japan, planting 3,000,000 small oysters—known scientifically as *Magaritifera martensi*—each year, performing a major surgical operation on each of them, then nursing the patients tenderly for seven years, an average of $2,000,000 worth of Japanese culture pearls is produced for world markets annually.

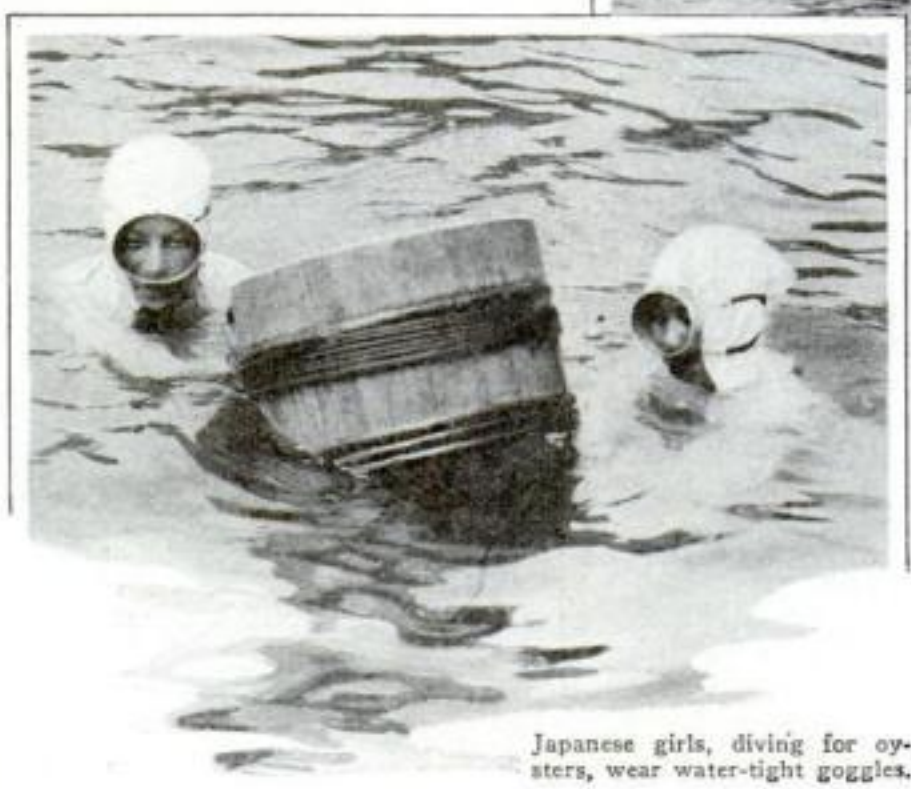
The originator and controlling factor in this strange industry is Kochichi Mikimoto, known as the "Pearl King" of Japan. For twenty-three years he operated nine "pearl farms" before raising a profitable crop. Now, though, by means of the scientific methods he developed, he and his thousand assistants care for 7,000,000 pearl oysters constantly, and the raising of culture pearls has ceased to be an experiment.

All pearls are produced by irritated oysters. A "wild," "natural," or "virgin" pearl results when a bit of sand, a minute crustacean, or some other tiny foreign substance accidentally gets into the oyster's body. If it is not able to eject the intruder, the oyster surrounds it with layers of a substance which, in time, becomes a pearl.

The Persian Gulf is famous for its "wild" pearl oysters. Many of them are brought from great depths by male divers. But relatively few of these bear pearls of profitable size and quality. The same was long true of Japanese pearl oysters until Mikimoto began to study them.

He began his career as a pearl farmer at Toba, on the Bay of Ago, about one hundred and fifty miles southeastward of Tokyo, the Japanese capital. The Bay of Ago is about on the latitude of Atlanta, Ga., and its waters are warmed by the Kurishiwo or Black Current, which flows northward through the Pacific Ocean from the more tropical Philippines.

This warm current is important, for a pearl oyster does not thrive in cold water. But the Bay of Ago had another advantage. It had a sandstone bottom and water as clear as that which came down from the green hills around Toba. In this bay, Mikimoto began wrestling with the problem of producing good pearls by artificially irritating oysters.



Japanese girls, diving for oysters, wear water-tight goggles.

After years of effort in this and five other bays in the vicinity, in another bay sixty miles south of Toba, in a bay near the more southern port of Nagasaki, at Yaeyama Island near Formosa, and at one of the South Sea Islands, he has solved his problem. The pearl farm that I visited is at Gokasho Bay, about thirty miles from Toba.

In this relatively warm arm of the sea, millions of small oysters, hatched naturally but under a certain amount of supervision, float for a while and then attach themselves to small stones strewn on the bot-

At top, a cage, containing 240 oysters, just after it has been raised to the surface of the sea. Larger picture shows how these cages, which protect the oysters from their natural enemies, are cleaned and tarred.

Inserting pearl nuclei on the operating table. At right, a regular cleaning.

tom. There they remain for three years. Then Japanese diving girls go down and get them.

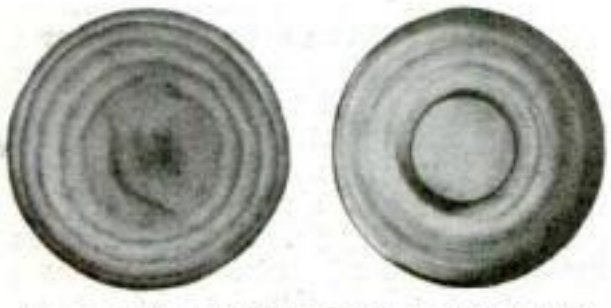
There is nothing fancy about these divers. They vary from fourteen to thirty years in age. Each lithe, coppery body is clothed in waist, knickers, and short skirt of white cotton or linen cloth. Tightly knotted black hair is wrapped in a white bandeau and black eyes are protected from sea water by large, snugly fitted goggles through which they may see well enough to search the depths for young oysters. They wear no helmets or other diver's equipment. No artificial air supply is used.

When these Nipponese mermaids are ready to bring up oysters they leap into the water, draw in deep breaths with a shrill whistling, kick their heels toward the sky, and plunge straight down twenty, forty, and even sixty feet.

After a minute or two they reappear, throw handfuls of oysters into tubs, one of which is tied by a rope to each diver's waist, whistle awhile, then dive again. In one day, preferably between May and November, for the divers do not like cold water, a lively girl will bring up a thousand oysters. Girls are said to make better divers than men because they have greater lung capacity.

Each captured oyster is placed on an operating table where the surgeon pries its shell open, makes an incision, deftly inserts a seed pearl not much larger than a pinhead or a tiny, round piece of mother of pearl from a Missouri River mussel shell, disinfects the wound, gently closes the oyster's shell, and passes the patient to the nearest tray loader.

This major operation is so delicate that, when first proposed by Mikimoto, expert culturists declared it could never be practical because most of the patients would die on the table. What makes the operation so difficult is the necessity of wrapping the future pearl's nucleus in a bit of mantle from another living oyster. That bit of mantle is then tied with a fine thread, and after the irritant has been inserted, the thread is slipped off. Yet more than a million such operations are performed at the various farms each year, and there are relatively few casualties.



Cross section of culture pearl shows how it is formed. Only experts can tell it from a natural.

Here is the pearl. It can be seen still clinging to the ancestral oyster, but now ready to be sold.

Fresh from the operating table, the prospective producers of culture pearls are laid, twenty to the tray, in especially made and patented wire cages, each holding fourteen of the trays. Fifty thousand of these cages, suspended from bamboo rafts, are hung simultaneously within a few feet of the ocean's floor. About half of the fourteen million oysters thus sustained, protected, and watched over while they take their nourishment produce pearls.

In the early days of culture pearl farming the young oysters, after surgical treatment, were returned to their native feeding grounds. But starfish and squids smothered many of them and the *mirumo*, a luxuriant seaweed, and barnacles did the bivalves no good. Hence suspended cages were resorted to.

Three times a year each cage is hoisted on its raft and cleaning crews remove the accumulated seaweed and barnacles, smear oysters and cages with lime or tar, and lower the shellfish back into the sea. After six years of this treatment, the mature oysters have done their work and are brought to shore and opened.

During the six years of alternate emersions and cleanings, about twenty percent of the oysters die. Another twenty percent prove to be pearlless. Of the sixty percent of pearl-bearing oysters only five or ten percent produce well rounded, well colored commercial pearls. The imperfect pearls are destroyed.

Like "natural" pearls, the cultured product can be dissolved in acids and destroyed by heat, and consist of calcium carbonate interspersed with animal substance.

Many of the culture pearls are flattened on one side, thus resembling Dr. Louis Boutan's "Southern Cross," found in the waters off West Australia and valued at $50,000. Like "natural" pearls, the culture pearls are more valuable when they are perfectly round, pear shaped, or oval with a satiny white or bluish white luster. But the culture pearl does not have the same market value as the "wild" or "natural" product, though they resemble each other so closely that only by cross sectioning or by examination under the recently invented double-eyed microscope or "pearlometer" can the average expert tell the difference.

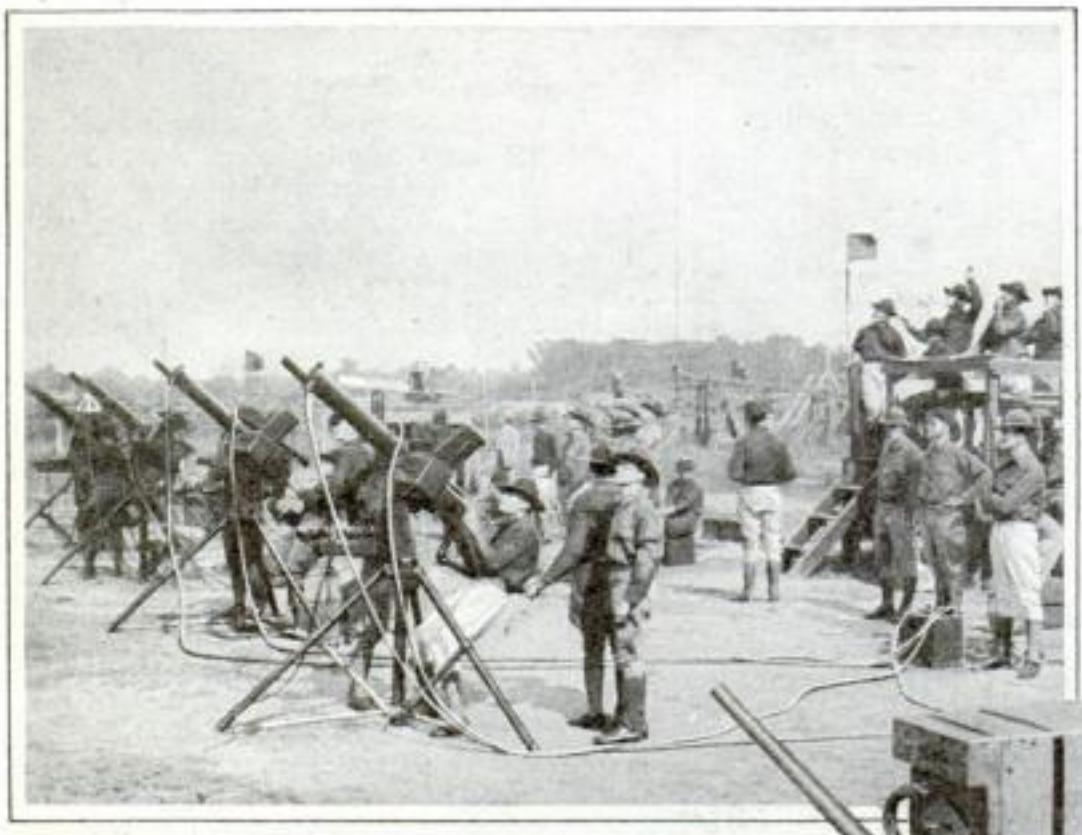
In two recent lawsuits, French courts held that "Japanese culture pearls produced by scientific stimulation of the oyster are in no sense false or imitation pearls and they can be sold as real pearls without any indication of their origin."

Cross sections of both natural and culture pearls reveal little variation in structure except in the nature of the nucleus. Sometimes that difference does not appear because of the variety of the natural foreign irritants.

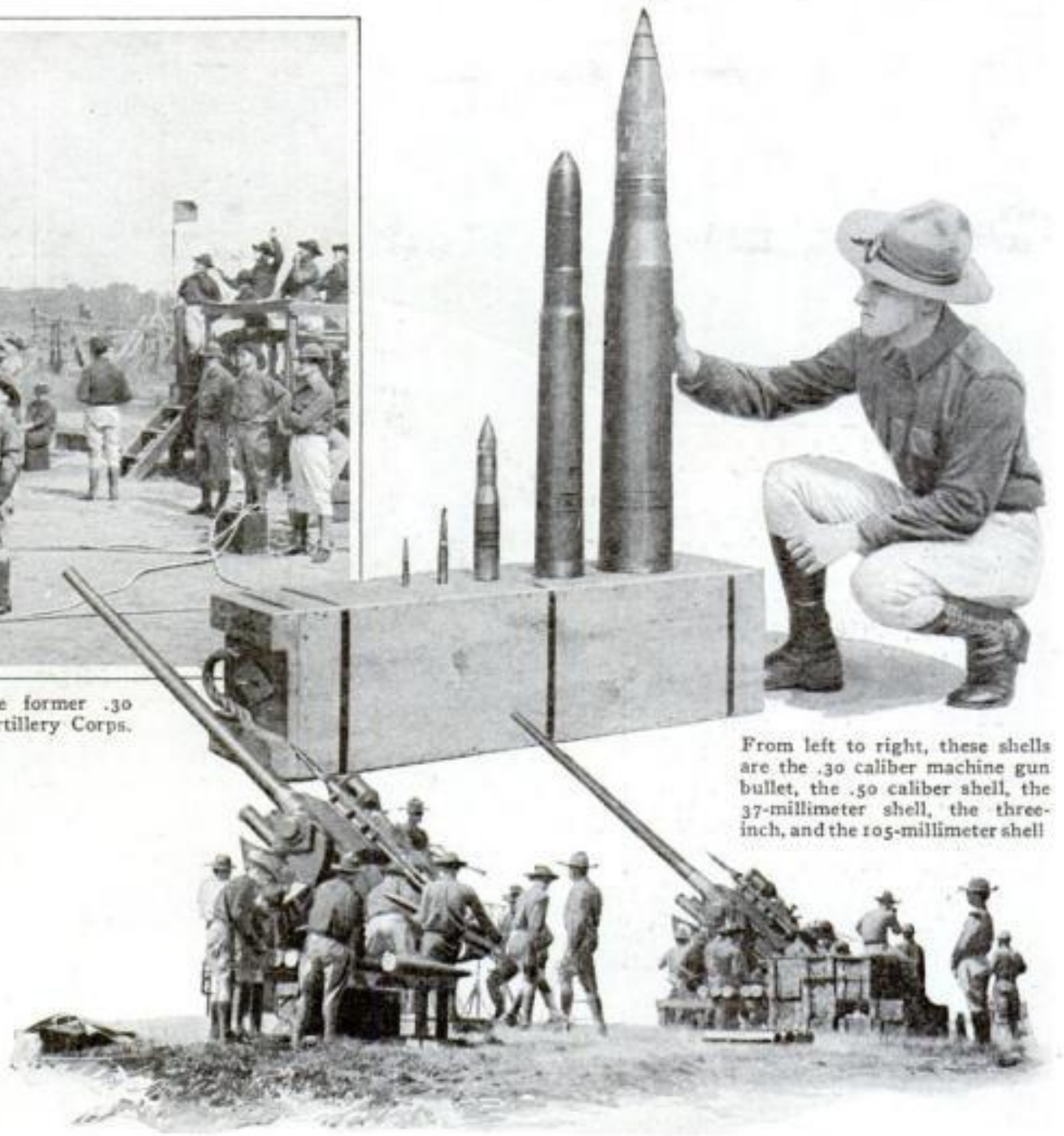
With the decreasing production of natural pearls, the production of culture pearls may become more general. California and Florida waters might be made to produce culture pearls abundantly. This abundance might become commercially profitable, for a string of one hundred perfectly matched culture pearls has sold for $15,000 in Japan.

Hence the United States Department of Commerce and the Bureau of Fisheries are actively interested in culture pearls. Experts of the latter Department have made a study of Florida sea waters to determine just where the dangerous frost line lies and whether the waters are properly protected from storms and have the right chemical composition and depth.

Big Bullet Explodes When It Hits Airplane Fabric



Antiaircraft guns of .50 caliber, replacing the former .30 caliber weapons, are tested by the U. S. Coast Artillery Corps.



From left to right, these shells are the .30 caliber machine gun bullet, the .50 caliber shell, the 37-millimeter shell, the three-inch, and the 105-millimeter shell

These 105-millimeter guns, with vast range, will be placed at strategic points on the coast.

A POUND-and-a-quarter bullet, so sensitive that it explodes on striking the fabric of an airplane's wing, was demonstrated a few days ago at the Government proving ground at Aberdeen, Md.

In the test of the guns, airplanes flew overhead, towing cloth targets at a safe distance behind them. The bullets, fired from mobile antiaircraft guns at the rate of 100 a minute, blew the targets to pieces. Because of their extraordinary sensitiveness, the thirty-seven-millimeter (1.4-inch) projectiles must be handled with unusual care. The extreme range of the gun is 7,700 yards.

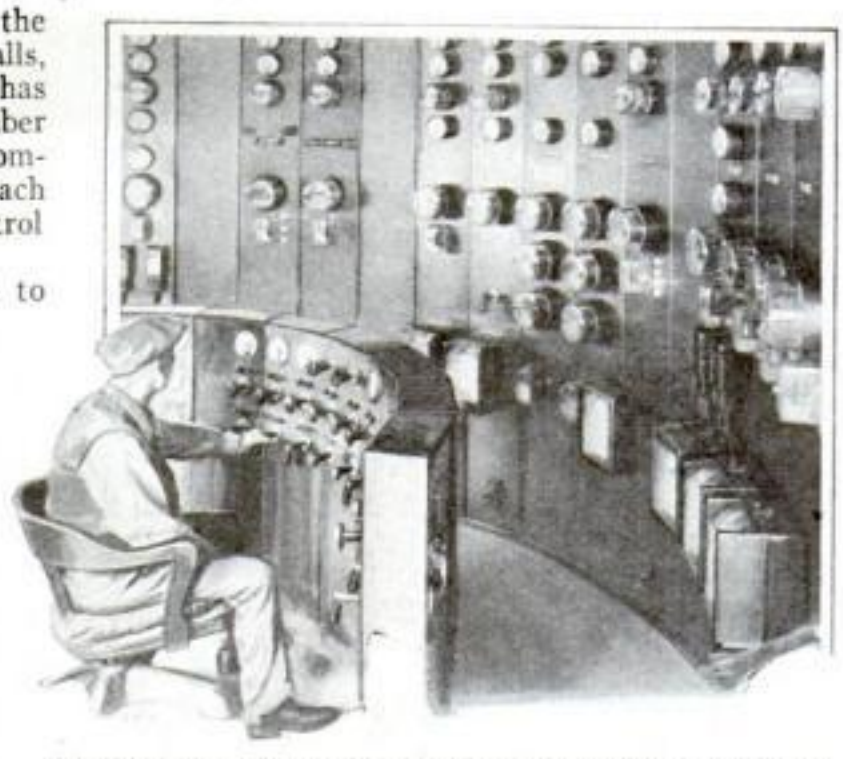
The demonstration was the high point of a series of tests, under the direction of the U. S. Coast Artillery, Air, and Engineers Corps, of the latest in military ordnance. Officials saw a new .50 caliber machine gun that replaces the .30 caliber weapon which was formerly used for aircraft defense purposes.

But these seemed puny beside the latest improved 105-millimeter (four-inch) fixed guns, designed for the protection of such strategic points as the Panama Canal. These guns can shoot nearly eleven miles in a horizontal direction, and fire a thirty-three pound projectile filled with high explosive.

RUNS SWITCHBOARD FROM ARMCHAIR

THE head operator at the switchboard of a Niagara Falls, N. Y., manufacturing plant has the easiest job of any member of his profession. From a comfortable armchair he can reach any of the switches that control the plant's electric furnaces.

Hitherto an operator had to walk back and forth along a row of switchboards to read the meters and adjust the controls. The new system, developed by engineers of the Westinghouse Electric and Manufacturing Company, places the most-used controls on a small board near the operator. On a larger circular board in the rear, out of reach but within easy eyeshot, are recording instruments, relays, and temperature indicators.



The head operator in a big plant at Niagara Falls, N. Y., can run the furnaces' control switchboard without leaving his chair.

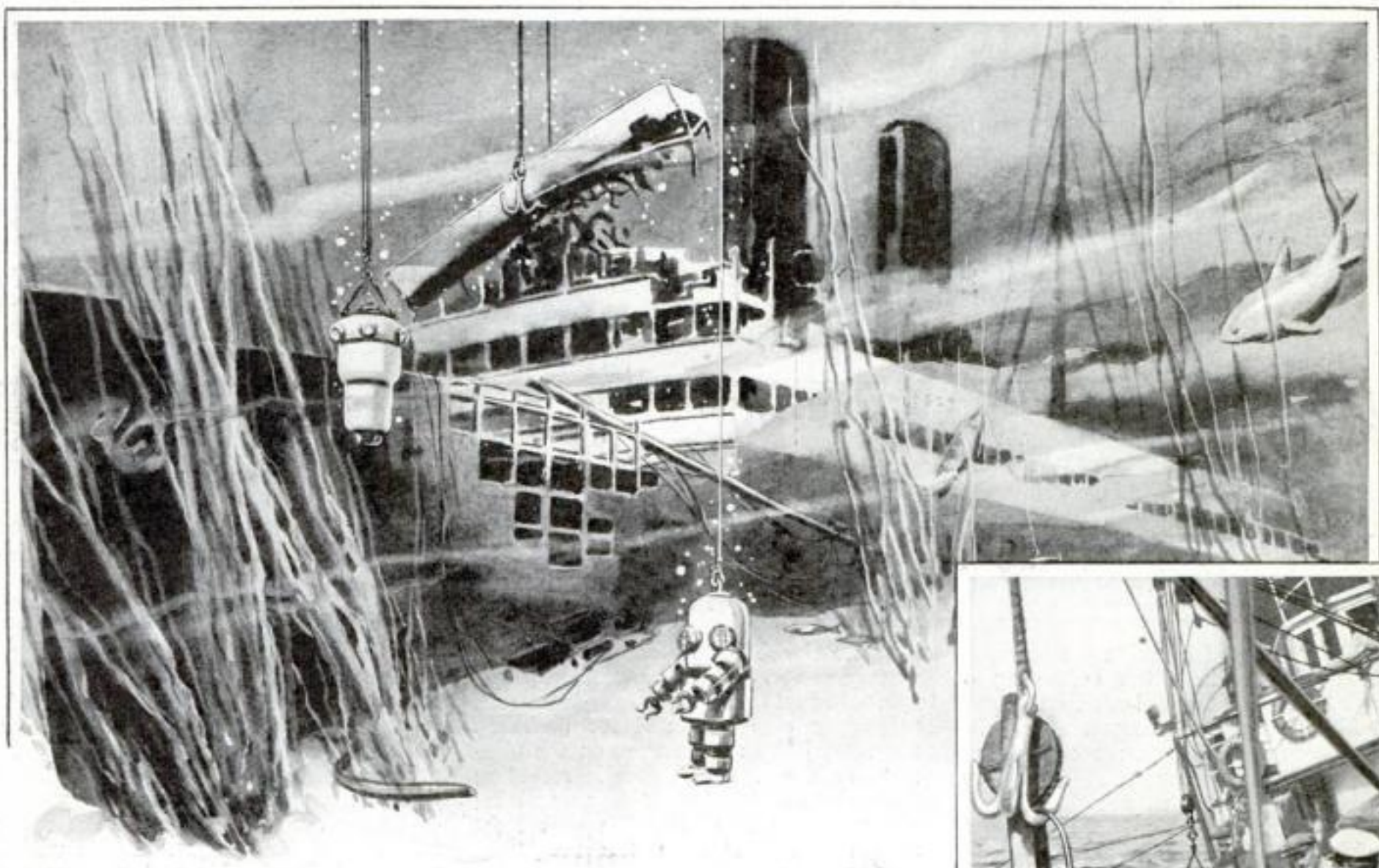
FARMER SEES INSIDE OF TORNADO—AND LIVES

How a Kansas farmer looked squarely into the hollow center of a tornado, and lived to tell what he saw, is reported by Alonzo A. Justice, of the Dodge City, Kansas, Weather Bureau office.

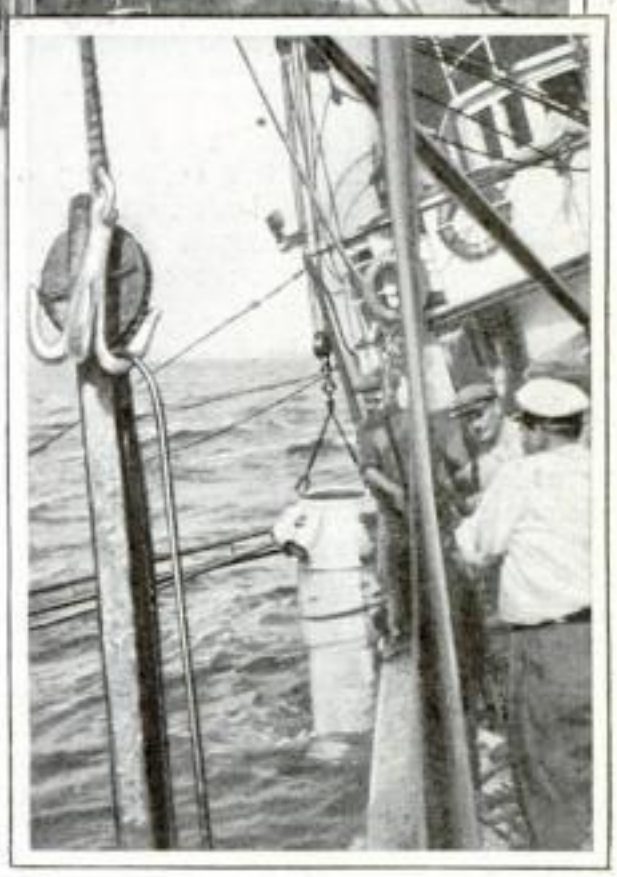
Will Keller, farmer of Greensburg, Kansas, sent his family to the cellar and remained to watch the tornado's slow, zigzag approach—a whirling funnel at the base of a greenish-black cloud. The tip of the cone had just risen away from the ground, and Keller knew himself safe unless it descended again. Ready to jump for the cellar if necessary, he stood his ground until the great shaggy end of the death-dealing funnel hung directly above his head.

From the tip of the whirling cone above him came a screaming, hissing sound. Looking up, Keller saw that the bottom of the tornado was an open hole fifty or a hundred feet in diameter. Through it he could look into the very center of the cone. Flashes of lightning inside the whirl illuminated the gyrating wall of clouds. A small detached cloud in the center floated up and down. Small tornadoes constantly detached themselves and went whirling away from the rim of the main funnel.

Divers Set Record Raising Gold from 400-Foot Depth



This drawing shows how divers are clearing away part of sunken ship 400 feet below the surface of the ocean so they can hoist out the treasure room, which is supposed to contain $5,000,000.



The treasure hunters raise one of the lost ship's cranes. Observation chamber is beyond it.

CUTTING loose an entire bullion room from a treasure ship 400 feet beneath the Atlantic, a salvage feat unique in marine history, may net $5,000,000 in gold and silver for the men of the Italian salvage ship *Artiglio*. When the three months' task is finished, they plan to hoist the room to the surface and carry it to land without losing a penny of the coins and gold bars, packed in wooden boxes, they believe it contains.

A collision sank the passenger liner *Egypt*, bound from London to Bombay, off the French coast near Brest eight years ago. Japanese, Swedish, and German divers in turn tried vainly to reach the treasure it carried to the bottom. Last spring the Italian ship *Artiglio*, armed with the most modern deep-sea diving equipment, arrived near the scene.

Six months of searching ended the other day when divers, in suits of heavy metal armor, spotted the *Egypt* lying amid seaweed on the gray sandy bottom, and identified her by seven hydraulic cranes she carried, a type no longer used. Three charges of explosive fired at record depth enabled one of them to be hoisted to the surface.

Magnets and grappling irons next brought up the captain's safe, which yielded the key to the treasure room. But rather than risk losing a part of the treasure if it were recovered with scoops, the men decided to detach the entire room and bring it up. The work is being carried on at a record depth for divers, while an observer in a specially-constructed steel chamber directs it.

The *Egypt's* cache of gold is one of many treasures that line the sea bottom. Probably the biggest haul ever made in undersea salvage was the recovery of $35,000,000 in gold from the *Laurentic*, sunk off Ireland in 1917 by a German submarine. But that feat was performed in only ninety feet of water, instead of four hundred. No submarine has ever been able to brave this latter depth, where the pressure of the water is tremendous, and divers work with difficulty because of the massive armor they wear.

NEW TANK DEVELOPS AIR MAP FILM

Compact developing tank for the huge rolls of film used by planes in making air maps, shown by its inventor, J. Wesley Smith.

THE development of large rolls of photographic film used in aerial surveying and mapping is made easier by a new style of tank recently adopted by the Army Air Corps. It is equipped with three tanks of developing solution, each of which is fitted with a new attachment for winding aerial films.

Although this tank was designed to handle large amounts of film, it is compact and may be easily transported. When packed for shipment it is only six inches wide, thirteen inches long, and a foot deep—about the size of a portable typewriter case. It contains two gallons of developing solution.

The tank was invented by J. Wesley Smith, of Philadelphia, a racing airplane pilot. It may replace tanks now in use, as they are not easily transported.

GERMAN BUILDS MUSHROOM HOUSE

No more strictly modern note can be found in German architecture than this mushroom shaped house, the dining room of which extends out over the River Rhine, giving a good view and making it cool in the summer.

THE type of problem concerning architects and engineers of the present day is well exemplified in a restaurant built on the banks of the Rhine River in Germany. This curious "mushroom" building illustrates the modern tendency to expand a structure from the bottom up and to employ geometrical forms in the design.

The stresses and strains introduced by such a design make a novel problem in themselves, especially in the arrangement of beams for the support of the upper floors. The dining room of this unique restaurant is circular and extends out over the river. The all-glass roof and large windows of unusual design complete the modern note. The unusual appearance of the building attracts attention and brings business. Also it provides the very maximum of light and air and an unobstructed view from all parts of the room.

NEW HARVESTER WORKS ON 60 PERCENT SLOPE

A NEW type of combine recently perfected will facilitate the harvesting of crops that have been planted on ground that has an uneven surface. A reaping attachment on a hinged shaft moves up and down over rolling ground, while the machine itself remains upright. It will operate over steep slopes, as shown in the picture.

Use of the combine has eliminated the necessity of binding grain stalks into sheaves and shocking and stacking them, as the crop is mowed, threshed, and bagged in the field. This eliminates much labor and machinery heretofore required for harvesting grain crops.

MOTORMAN'S REACTIONS TESTED

WHEN the Boston Elevated Railway recently discovered that more than half its accidents were caused by only twenty-seven percent of its men, it inaugurated a novel series of psychological tests to find the reasons for the troubles of the small "accident-prone" group.

An "L" motorman should be able to respond to the change of a signal in front of his train in as little time as one fifth of a second. So railway officials rigged up a unique machine to test his ability.

While signal lights mounted on a laboratory wall flashed "stop," "caution," and "go," the motorman was required to work a dummy controller and air brake in response, just as if he were on the platform of a car. An automatic recording device marks pencil dots on a revolving roll of paper to show when each light flashed and how soon the motorman responded to it.

Another device used to test motormen was a semicircular car of wood painted dead black and covered with a row of electric lights. This tests his sideways vision. While looking directly at the center, he must be able to tell when lights at the side are flashed, and how many. The data secured by these tests are used to determine the man's fitness, not only to meet emergencies, but to operate the train safely under ordinary running conditions.

Motorman works controls in test of his reactions. At left, he counts side lights while looking ahead.

With this vacuum tube and an electric eye, the heat of the most distant stars is found.

STAR'S HEAT MEASURED BY NEW VACUUM TUBE

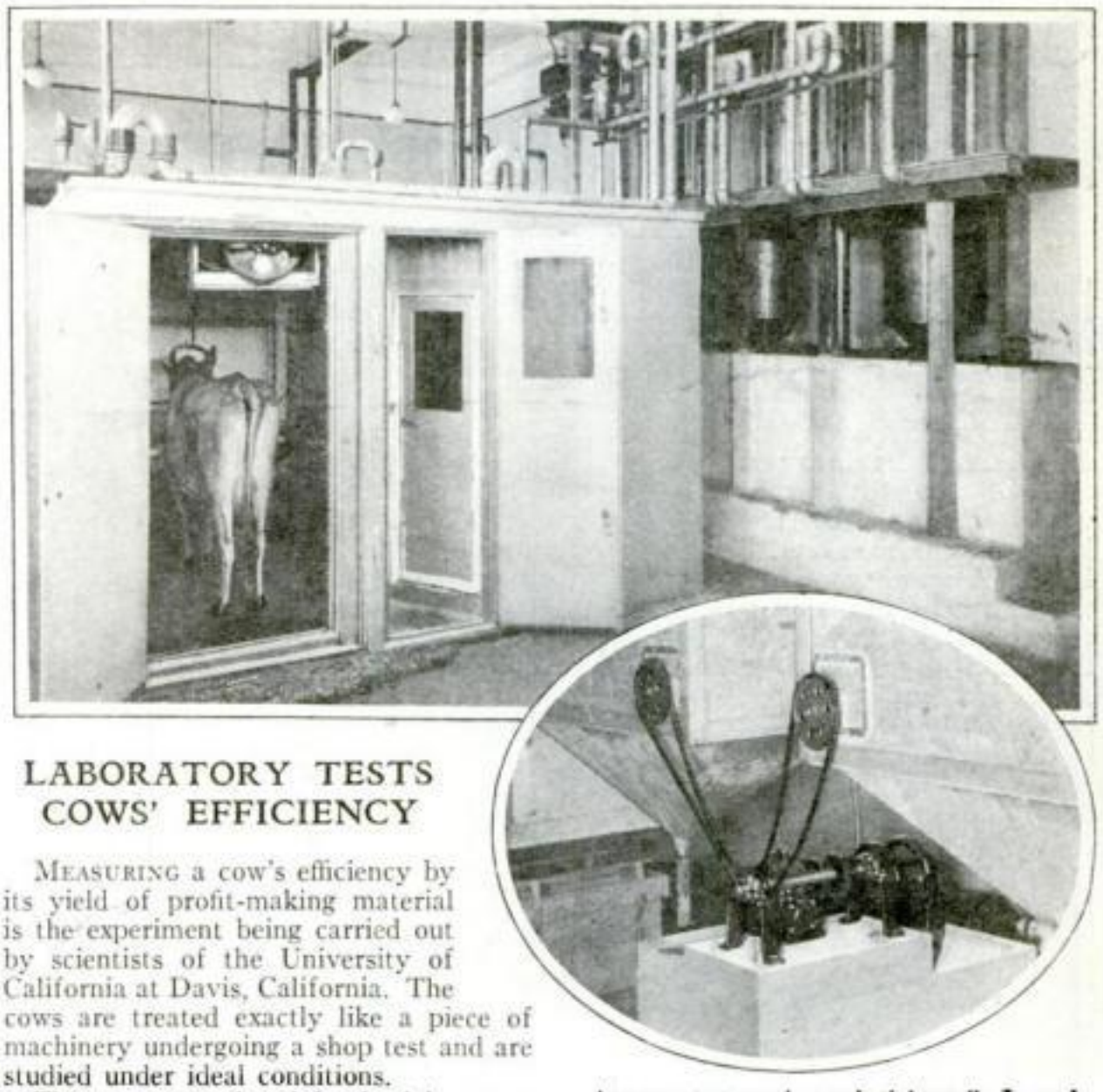
ONE hundredth of a millionth of a billionth of an ampere can be measured by means of a new type of vacuum tube perfected by General Electric engineers. It will be used with an "electric eye," or photo-electric cell, for determining the heat of stars so far away that the most powerful telescopes reveal them only as tiny points of light.

Five Minutes of ASTRONOMY

YOUR FIST IS A CALENDAR

Most people avoid the difficulty of remembering the varying numbers of days in the months by memorizing the old stanza: Thirty days hath September. . . ." If the stanza becomes hazy in the mind, the uncertainty remains.

Here is a method of fixing the succession of long and short months that cannot be forgotten. With the fist closed, count out the months on the knuckles and the hollows between, as shown in the illustration. When July is reached, on the fourth knuckle, start again at the top with August and proceed as before to the end of the year. Each knuckle will then represent a thirty-one-day month, and each depression a thirty-day one. February, Leap Year month, must be remembered individually.



LABORATORY TESTS COWS' EFFICIENCY

MEASURING a cow's efficiency by its yield of profit-making material is the experiment being carried out by scientists of the University of California at Davis, California. The cows are treated exactly like a piece of machinery undergoing a shop test and are studied under ideal conditions.

The cows are placed in the laboratory stalls where they are fed, milked, and watered under careful observation. Even the air they breathe is measured. This necessitates the use of a mechanical breathing device called an "aspirator," and makes it necessary that the stalls be placed in an air-tight compartment. Attendants and observers have access to the stalls by means of air locks. Fodder is passed into the stalls through water-sealed feeding troughs.

At top, a test cow in an air-tight stall. In oval, the classifier which separates the waste products.

BIG LOUDSPEAKER HEARD THOUSANDS OF FEET

SHAPED like a huge button, a loudspeaker developed at a Chicago airport makes sound audible at a distance of several thousand feet but causes no discomfort to those near it. It is designed for use at big outdoor events.

In action the speaker resembles a searchlight, throwing beams of sound instead of light. As these are sharply defined it is possible to arrange the speakers so that their beams will completely cover any area that may be occupied by listeners. In spite of its size, five feet in diameter, the speaker does not produce violent pulsations of air.

GERMAN HOMES BUILT IN CIRCLES

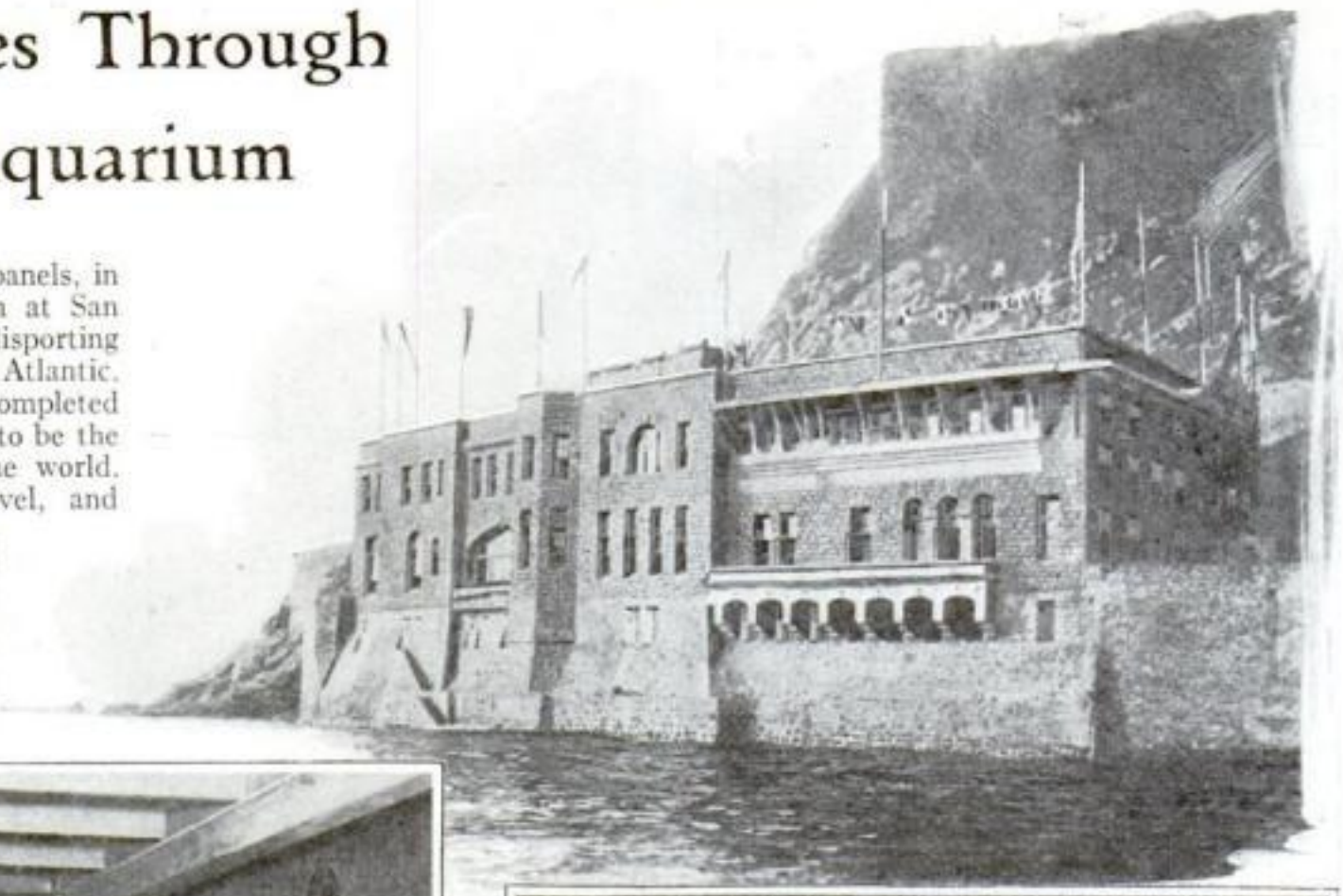
A NOVEL housing project at Leipzig-Loessnig, Germany, is laid out in three concentric rings of buildings with streets radiating outward from its center like spokes in a wheel. Municipal Architect M. Ritter, who designed Rundling, the name of this settlement, planned it to furnish the greatest amount of light, air, and recreation space to the greatest number of people.

Latest design for German apartment houses. The buildings are erected in three concentric circles, those on the inside being higher than those in the next outer circle.

Loudspeakers of this type, looking like great five-foot buttons, throw sound thousands of feet.

Ocean Washes Through Spanish Aquarium

FISH that swim behind glass panels, in the new Oceanographic Museum at San Sebastian, Spain, are actually disporting themselves in the waters of the Atlantic. This unusual museum, recently completed and opened to the public, is said to be the first underwater aquarium in the world. Its basement is below sea level, and screened passages admit sea water directly to the chambers in which the fish are kept. There is no problem of supplying fresh water to the rare varieties kept there, of which a few are shown in the accompanying photographs.



The basement of Spain's new museum is below sea level and ocean water is admitted through screened passages so the captured fish live in their native element.

At top, exterior of the first underwater aquarium; and one of its sea-flooded rooms.

At left, the salt-water frog which has climbed up to have a good look at the visitors who watch it in the aquarium.

Many strange sea creatures are found in this aquarium, among them being this representative of the globe-fish, which derives its name from its appearance when self-inflated with air.

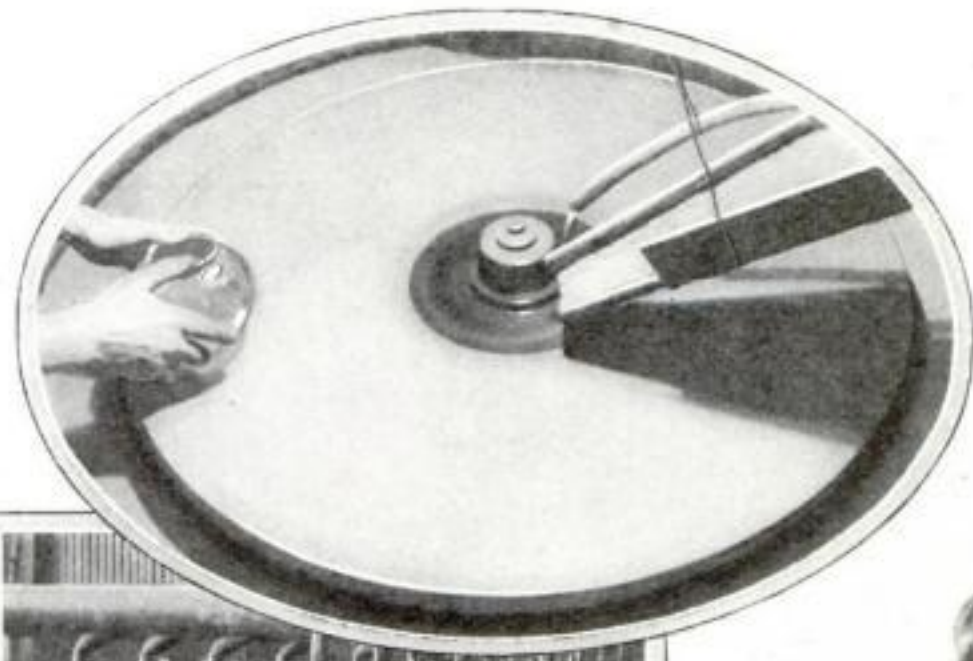
This lobster is really living in a state of nature on the bottom of the sea, but through the glass sides of his apartment he is visible to all.

An odd photograph of a salamander taken while it was crawling up the side of the glass window in its prison. A good view of the padded fingers of the animal about which legends have been woven is provided by this picture.

At left, the electric glass fish. This strange creature, now housed in the new aquarium, is just an animated light, flashing brightly in the sea water.

Acid Etching Now Used in Novel Way to Make Dainty Glassware

The raw material from which glass is made. Sand is put through a sieve and the sifting process is repeated until all foreign matter has been removed.

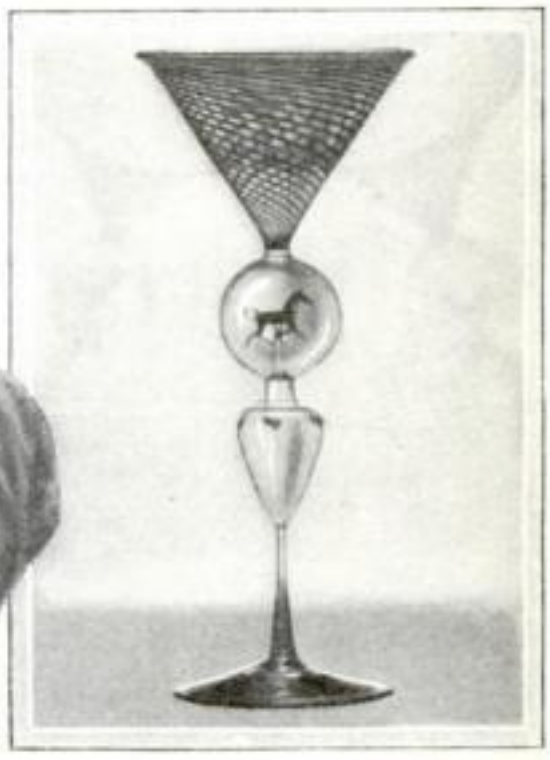


At left, the rotating emery wheel against which glass article is held in one of the finishing operations.

Molten glass, still in its mold, is placed on this press. A plunger, fitting the mold, is forced down inside it and the glass thus gets the desired shape inside and out.

Judean tar keeps glass transparent during its acid bath. Below, the finished article, a dainty glass of artistic design, ready for the market.

Molten glass, inside an open mold, is blown into shape and then the mold is closed and locked in place.



GLITTERING modernistic patterns in pressed glassware, in the form of goblets and vases, are now on the market. The photographs on this page, taken recently in the workshop of a Paris glassmaker, show how such pieces are made.

Sand, the raw material of glass, is melted at a temperature of 1,100 degrees centigrade. In this molten state, it is dropped into a mold that has been carefully designed by artists. A press descends and then rises immediately. The shaped piece is removed from the mold and baked. After it has cooled it is examined for imperfections and if flawless, it is polished on a rotary wheel. Parts that are to remain transparent are coated with Judean tar. Acid makes exposed parts opaque.

PHONE-HOLDING BRACKET LEAVES HANDS FREE

ACROBATIC skill in holding the receiver between shoulder and chin when telephoning, in an effort to free both hands for something else, is no longer necessary if a receiver-holding attachment is fitted to your phone.

The new appliance is merely a bracket that bolts to the phone back of the transmitter and holds the receiver at the proper elevation and angle for convenient use. Slipping back a latch releases the hook and opens the line. When the call is completed, pressing down the hook automatically locks it shut. The holder attaches in place of the rivet found behind the transmitter.

This bracket fastened to the transmitter of a phone holds the receiver.

The device should prove particularly welcome when it is necessary to "hold the wire" for a considerable time.

NEW BRIDGE TABLE HAS CARD COMPARTMENT

ANNOYANCE caused by hunting for cards, pencils, and ash trays before starting a bridge game is eliminated by a new folding table. This is accomplished by means of a hidden compartment at one side of the table, which opens at the pressing of a button.

Other features of the table that, it is expected, will appeal to card players, are the sturdiness of construction and the moisture-proof material with which it is covered. The braced legs are solid, though there are no metal corners to catch clothing. The covering, which can be wiped clean with a damp cloth, is not stained by liquids that may be spilled on it. As a result it can safely be used in serving refreshments. The table was designed primarily to be serviceable, but as attractive hardware and nonwarping hardwood were used, it is said to have a decidedly pleasing appearance. It folds compactly and is easily put away when not in use. Rules and values of tricks are printed on placards fastened to underside of the compartment lid.

A hidden compartment in a new folding bridge table has room for pencils, cards, and ash trays.

By means of this loudspeaker, phonographic music is being used in German churches.

PHONOGRAPH MUSIC NOW USED IN CHURCH

CANNED music for churches in Germany is being tried out in an effort to cut the cost of religious services.

Installation of organ and assembly of organist and choir are expensive and the poorer churches in the country districts have difficulty in procuring satisfactory music. A Berlin inventor, in order to meet this situation, invented a loudspeaker to be used in churches in connection with a phonograph. Put in a Berlin church, results are said to have been excellent.

The cost of installing the system is small compared with that of putting in an organ, and the music is superior to that generally obtainable in small churches.

A choir boy in a Berlin church places a record on the phonograph which furnishes music during the services.

GRADE PUPILS BY EYE MOVEMENTS

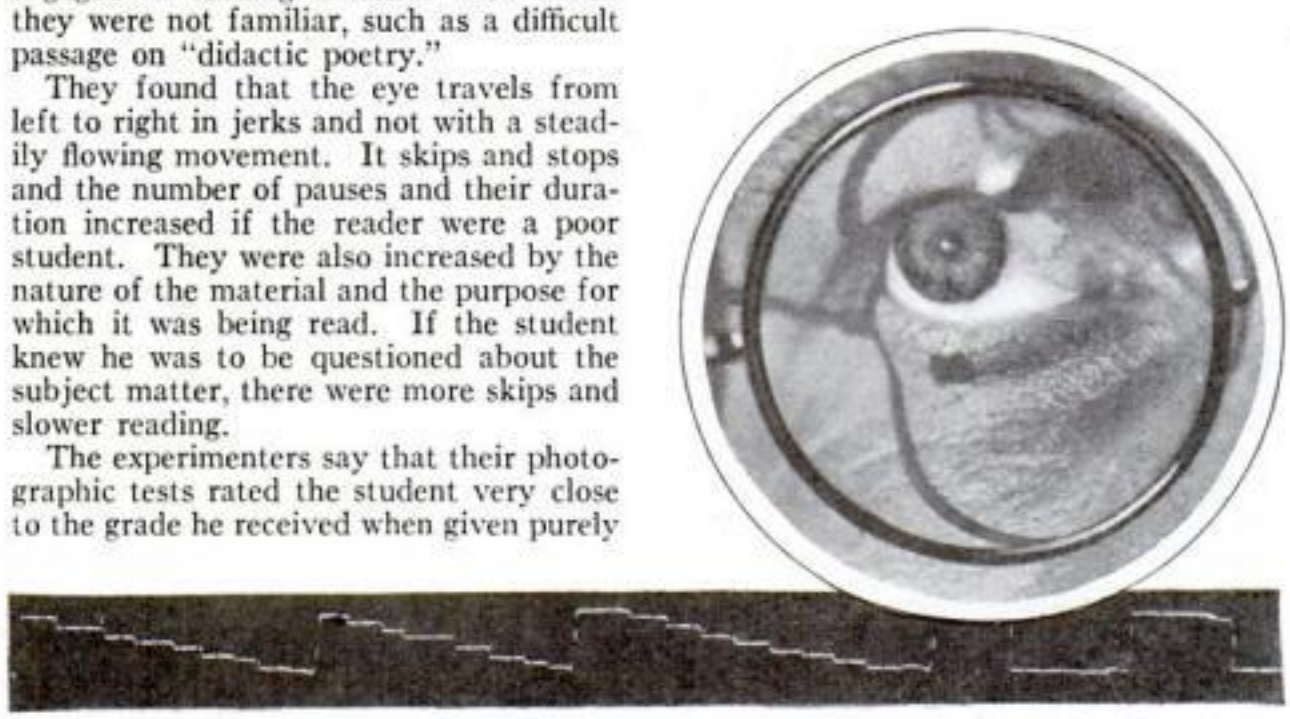
BRIGHT university students read fast while the dull ones make a hard job of it. The words at the left end of a line are read more carefully than those at the right end. That's the reason typographical errors in printed material are more likely to get by at the right side than the left.

These are some of the conclusions arrived at by W. R. Miles and H. M Bell of the Psychology Laboratories of Stanford University, California. In order to get the data upon which they based their deductions, they made photographic studies of the eye movements of students engaged in reading material with which they were not familiar, such as a difficult passage on "didactic poetry."

They found that the eye travels from left to right in jerks and not with a steadily flowing movement. It skips and stops and the number of pauses and their duration increased if the reader were a poor student. They were also increased by the nature of the material and the purpose for which it was being read. If the student knew he was to be questioned about the subject matter, there were more skips and slower reading.

The experimenters say that their photographic tests rated the student very close to the grade he received when given purely mental examination. With this fact as a basis, they believe that the study habits of pupils can be greatly improved by an analysis of their eye movements in reading. Stumbling, or what the psychologists call "confusion spots," indicate a lack of comprehension and concentration, two faults that individual work would tend to remedy.

Similar experiments made on young children gave exactly the same results, suggesting that this eye-movement method can be used to assist the work of those in the primary grades, as well as pupils doing college work.

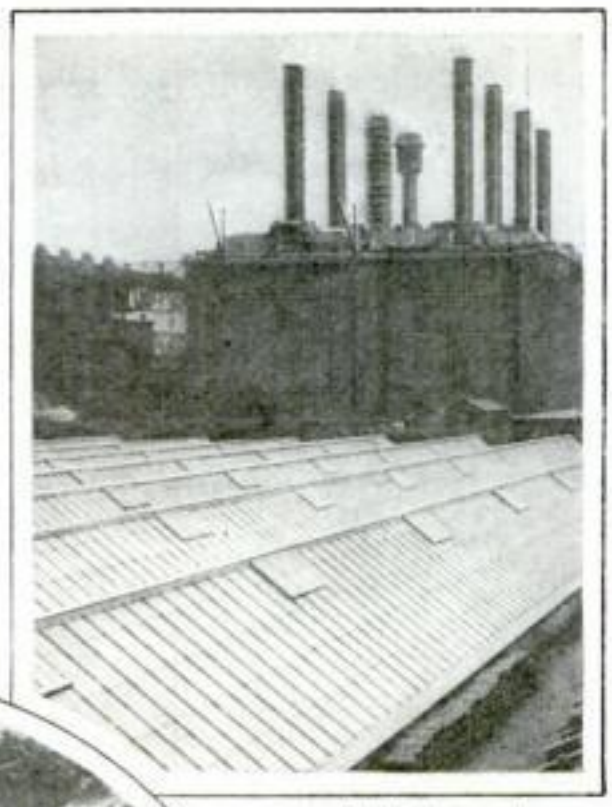


Eye movements indicate the student's ability to grasp the subject matter before him. The white spot in the eye shifts in reading and the white lines above show how camera records these jerks.

POWER PLANT WASTE WARMS HOTHOUSES

LARGE power plants warm great quantities of water in their steam condenser systems. Ordinarily this heat is wasted by allowing the warm water to flow back into the river. Those in charge of the city power station for Berlin, Germany, have found a way to utilize this heat by pumping the warm water through heating coils in a large hothouse built next the power plant. Large crops of hothouse vegetables, including the cucumbers used to make dill pickles, have been successfully grown.

This new utilization of waste heat may soon be tried out for similar purposes in the United States.



The hothouses shown here are operated in connection with the Berlin power plant. They are heated at slight cost by waste heat from station.

At left, inside one of the electric plant's hothouses. Prize vegetables are grown in them, one of the chief being cucumbers to be used for making dill pickles.

FOOTBALL HELMET HAS MASK OVER EYES

NECESSITY sharpens men's wits, and Coach Lud Wray, of the University of Pennsylvania football team, is no exception. One of his star players, Frank Jablonski, is nearsighted and cannot play the game without wearing glasses. This was dangerous, for things more durable than glass have been broken in football games. Wray designed a helmet for Jablonski with a protective mask into which are fitted the special spectacle lenses.

Frank Jablonski, Pennsylvania football player, with his helmet that has special spectacle lenses.

RADIO SET BUILT INTO NEW PIANO

A PIANO and radio receiver combined in one instrument was exhibited at the recent national radio exhibition held at Berlin, Germany. The new piano has the radio set built into it, with the tuning dials immediately in front of the player as he sits on the stool.

Also an integral part of the piano is the loudspeaker, which is designed to use the front of the instrument as a baffle board. The combination is so arranged that the appearance of the piano is not distorted.

The intention, of course, is to hide the radio set so that it will not be a conspicuous object in the room and at the same time keep it as easily accessible as possible. The antenna and electric connection pass up through the back of the instrument to the radio and are therefore hidden. All of this is in general line with the recent movement in the radio field, where the present aim is to conceal.

Inclosed within case of this piano, recently shown in Berlin, is a radio set. Dials and loudspeaker are seen.

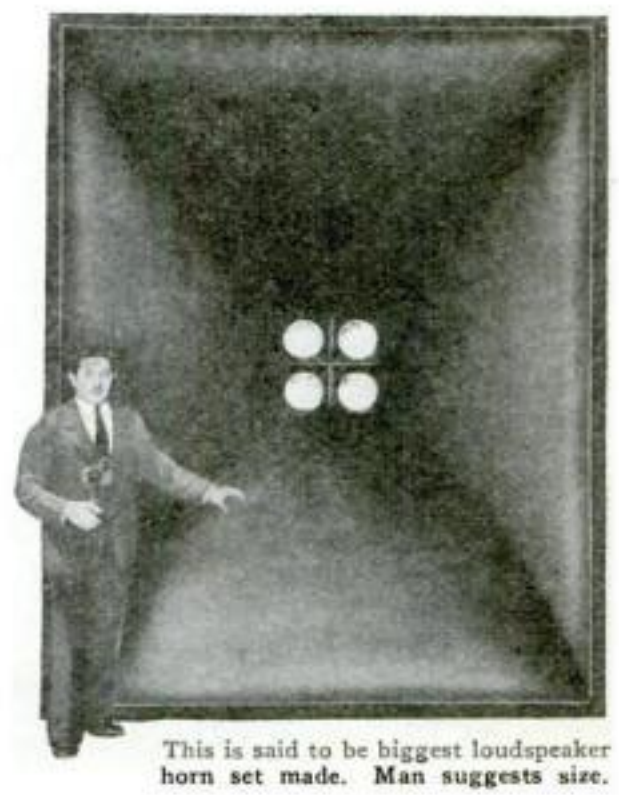
URGE FACTORY WORKERS TO WEAR THICK SPATS

WORKMEN are advised to wear spats in a recent report of the National Safety Council—particularly workers with hot metal. The purpose is not personal adornment, but to protect the workers' feet. Though a pair of spats may be considered foppish in a factory, it is an effective protection against sparks or droplets of hot metal.

Foot injuries, at present, are blamed for a large proportion of painful industrial accidents, some of which have fatal results. Hence safety measures are essential and they may take the form of shields, heavy overshoes, thick soles, or the recently recommended spats.

LARGEST LOUDSPEAKER HORN FOR AUDITORIUM

DESIGNED for use in auditoriums, the biggest loudspeaker horn yet made has recently appeared on the market. Its twelve-foot opening gives it the appearance of the entrance to a tunnel into which an automobile could be driven. The claim is made for it that it will reënforce notes down to twenty-five vibrations a second and project it with no appreciable loss of tone quality, to the farthest corners of a large concert hall.



This is said to be biggest loudspeaker horn set made. Man suggests size.

Two vanes, a small propeller, and a pendulum hold this mail plane on a level keel without the assistance of the pilot.

VANES HOLD PLANE LEVEL

AN AIR mail plane which recently took off on its regular scheduled flight from Cleveland, O., to Pittsburgh, Pa., is called the first to be equipped with an "automatic pilot." The device keeps the plane on an even keel in clouds or fog. The pilot has merely to steer right or left with his horizontal rudder.

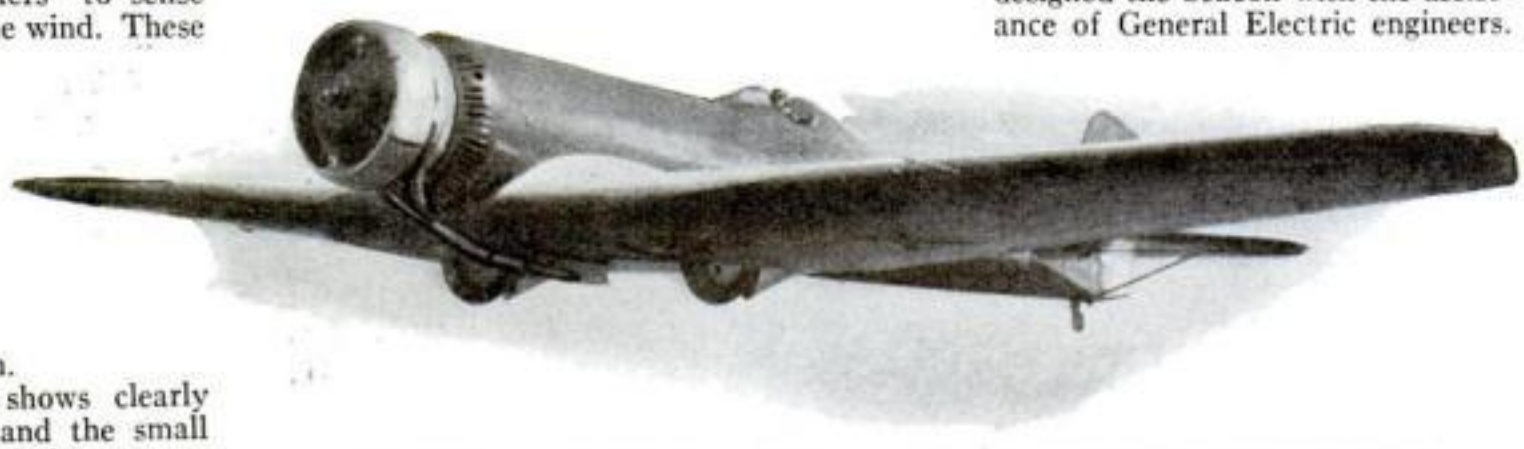
The newest "automatic pilot" is the invention of Otto W. Greene, of Elyria, O. Its two vanes, mounted in front of the airplane, serve as "feelers" to sense the direction and force of the wind. These work together with a small propeller mounted behind the plane's main propeller, and a pendulum hung in the fuselage, to trim the ship. In tests it is said that the device has even been able to land a plane, and guide it in a take-off, without human intervention.

The photograph above shows clearly the position of the vanes and the small propeller just above the cockpit.

Chicago's sunlight and neon mirror air beacon is dedicated. Designer of the light is fourth from left.

SUNLIGHT BEACON GUIDES AVIATORS

IN FULL daylight, as well as by night, a beacon recently erected in Chicago will be visible to aviators miles away. Curved mirrors catch the sun's rays and reflect them in eight directions during the day. At night they send out beams from scarlet electric neon tubes. A Chicago architect, Andrew N. Rebori, designed the beacon with the assistance of General Electric engineers.

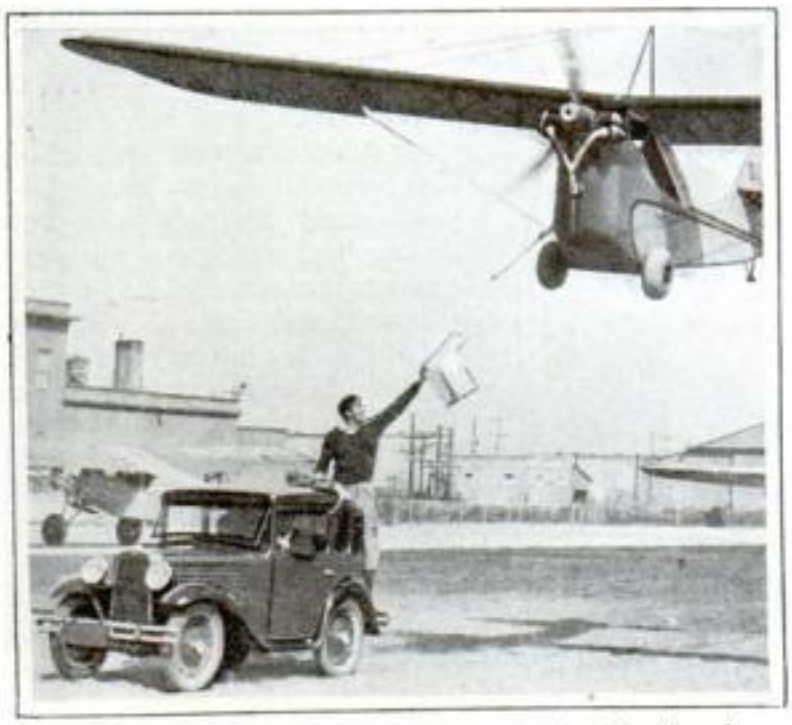


This highly streamlined Boeing mail plane, seen above in flight, tucks its wheels away as it rises from the ground. It is now in service on the Chicago-San Francisco air route.

NEW MAIL PLANE HIDES WHEELS AS IT RISES

WHEN the newest of the mail planes leaves the ground, the landing wheels swing backward and tuck themselves away in the lower side of the wing. A study in streamlining, the 158-mile-an-hour "Boeing Monomail" is shaped so that its speedy passage through the sky meets with the least possible air resistance. Recently the all-metal craft was placed in regular service on the air mail route between Chicago and San Francisco.

A glance at this low-wing monoplane's lines shows how far airplane designers have progressed since the "bird-cage" biplanes, crisscrossed with struts and wire braces, of fifteen years ago. The "Monomail's" fuselage tapers like a cigar, and is broken only by a low windshield for the pilot. Around the motor a newly-developed type of cowling further reduces wind resistance.



Flying at slow speed close to the ground, this tiny airplane picked up gas from an automobile racing below it.

PLANE, IN FLIGHT, REFUELS FROM CAR

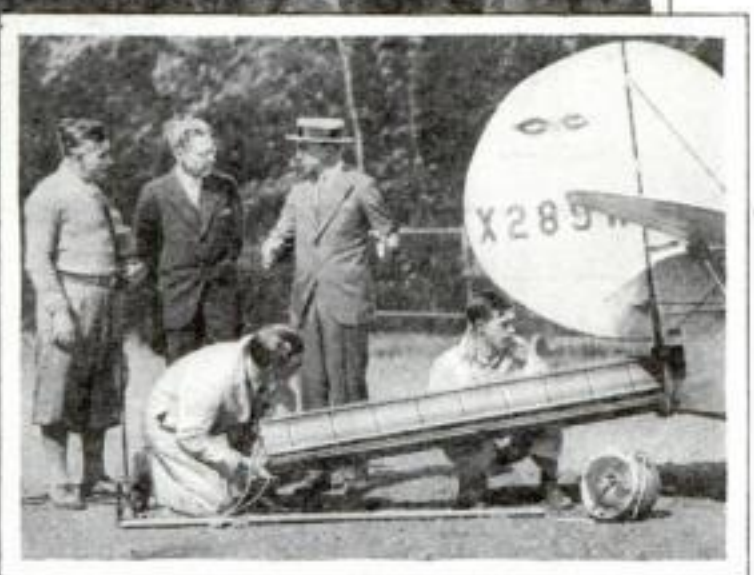
THE easy unconcern with which a pilot can fly a light "powered glider" near the ground and above spectators heads received a striking demonstration at Alameda, Calif., the other day. F. M. Johnston, of Oakland, steered his diminutive two-cylinder plane over a speeding auto, and picked up a supply of fuel in five-gallon cans by means of a trailing rope. Then the plane put-putted aloft with its tanks replenished.

It is claimed that this is the first time any kind of a plane was ever refueled from an automobile.

PARACHUTE LOWERS PLANE AND PILOT

Plane lowered by 'chute hits tree.

AN AIRPLANE that carries its own parachute in its tail received its first test the other day at Detroit, Mich. When the daring pilot, Vance Breese, put the ship into a deadly tail spin and pulled the 'chute release cord, the plane came swinging slowly down under the big umbrella of canvas. The plane was slightly damaged, but Breese was unhurt.



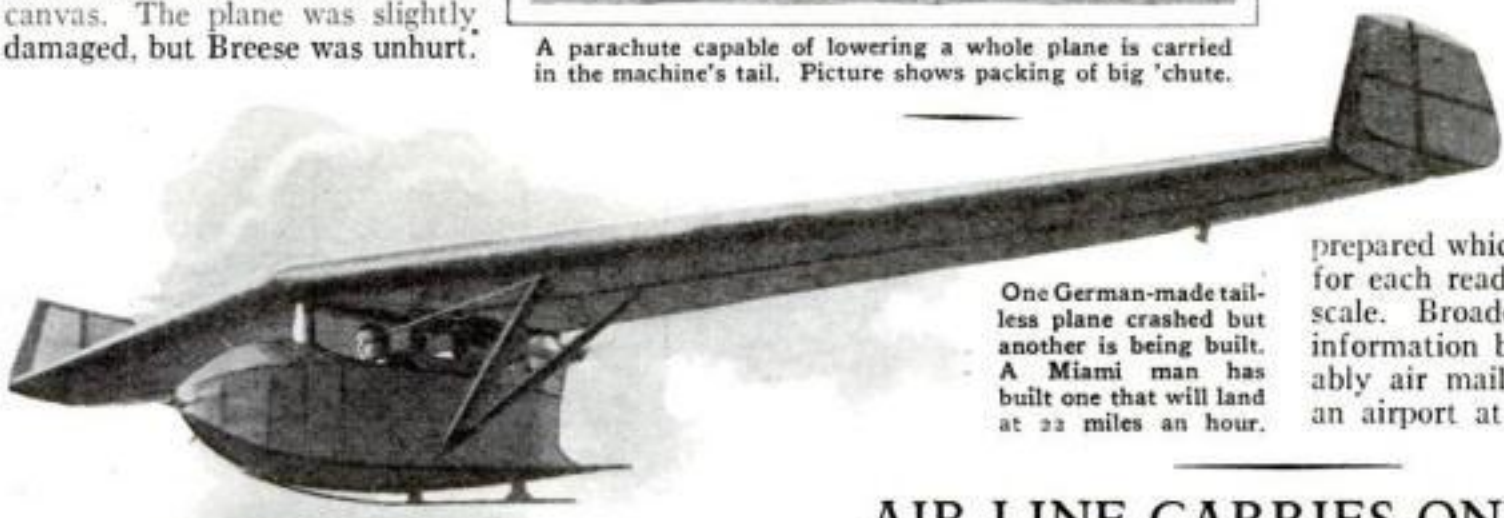
A parachute capable of lowering a whole plane is carried in the machine's tail. Picture shows packing of big 'chute.

NIGHT FLYERS CAN NOW TELL CLOUD'S HEIGHT

SOON all airports having weather observers will receive a curious little instrument that looks like a short telescope, with a curved scale attached. It will enable observers for the first time to determine quickly the height of clouds over the airport at night—an important piece of information for night-flying planes.

The new instrument, invented by Dr. C. F. Marvin of the U. S. Weather Bureau, is called a clinometer and is used together with a searchlight. First the searchlight is trained straight up, pointing at the bottom of an overhanging cloud. An observer 1,000 feet away then sights through the clinometer at the spot of light made by the searchlight on the cloud.

A pendulum hanging on the side of the instrument shows the angle at which it was pointed, and a simple mathematical formula reveals the cloud's height. To save even this bit of figuring, a chart has been prepared which shows the height of clouds for each reading of the pendulum on the scale. Broadcasting of this cloud-height information by radio would aid considerably air mail or other pilots arriving at an airport at night.



One German-made tailless plane crashed but another is being built. A Miami man has built one that will land at 22 miles an hour.

TAILLESS PLANE LANDS AT LOW SPEED

UNDAUNTED by the crash of his first novel "tailless" plane, a German designer recently built an improved model of even larger size. The photograph above shows its curious appearance as it recently flew over a Berlin airport.

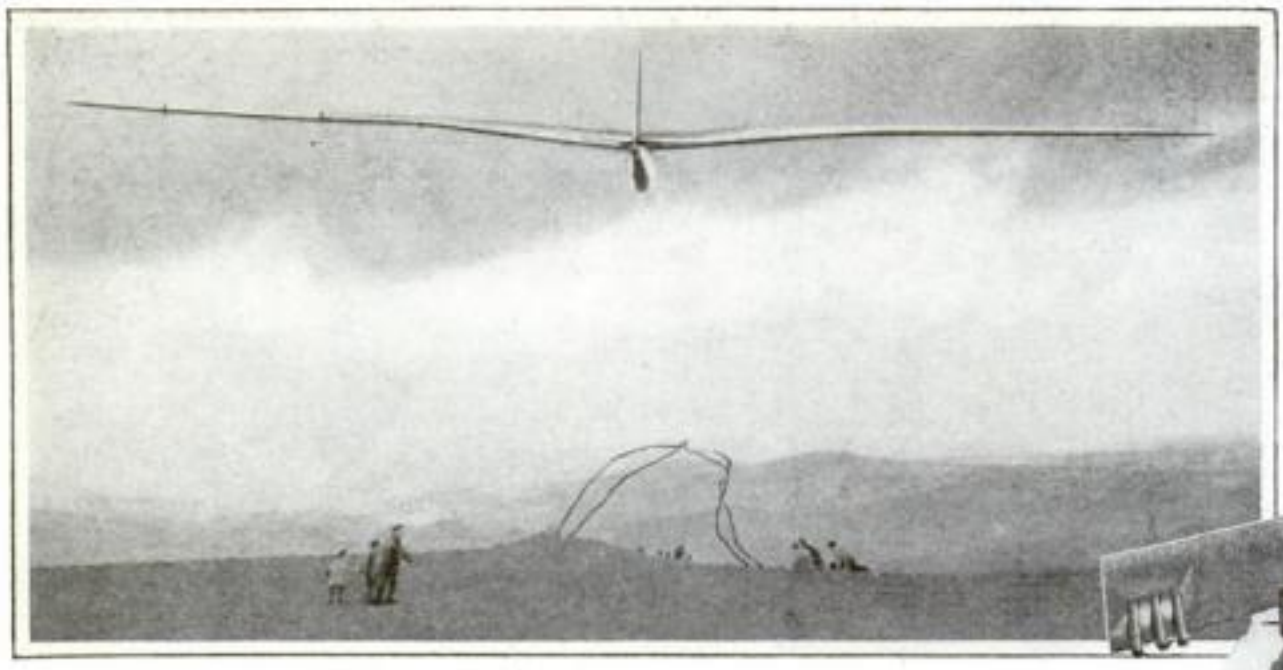
An American, Major B. L. Smith of Miami, Fla., has just completed a similar "tailless" plane that can land at twenty-two miles an hour.

AIR LINE CARRIES ONLY FREIGHT

One of the air freighters put in service on a recently opened Pacific coast line. Here freight is being loaded.

THIS air line takes no passengers, and it does not carry mail. Express and freight packages are its exclusive cargo along a Pacific coast route. The first of the specially designed freight monoplanes recently left the Los Angeles terminus for its initial run.

The unusual venture in air transport answers a growing demand for swift transportation of goods, such as only air express can provide. Two factors make it profitable—the willingness of companies to spend extra sums to rush new machine parts, for example, to a factory when a broken part has caused a shutdown; and the modern design of planes to carry unusually high "pay loads" besides their own and the pilot's weight.



SOARING GLIDER LOOKS LIKE GIGANTIC BIRD

"IT'S the nearest thing to flying like a bird," say the men who fly motorless gliders. And the curving wings of the soaring craft in this striking photograph, taken during a recent gliding meet in the Rhoen Mountains of Germany, suggest those of some giant mountain bird.

The pilot, flying one of the latest models of gliders, has just been launched and is off to a fine start for a distance record. The rubber "shock cord," an elastic tow-rope by which the ground crew launch the glider, can be seen falling from the nose of the craft after it has served its purpose.

To a glider novice who has previously flown in an airplane, the most startling thing about a glider flight is its silence. A pilot of a motorless craft can soar a few feet above the heads of his fellows and converse with them in an ordinary voice.

The photograph above shows the type of country which has proven best for glider soaring. It was here that the recent non-stop record of 101 miles was made by Robert Kronfeld.

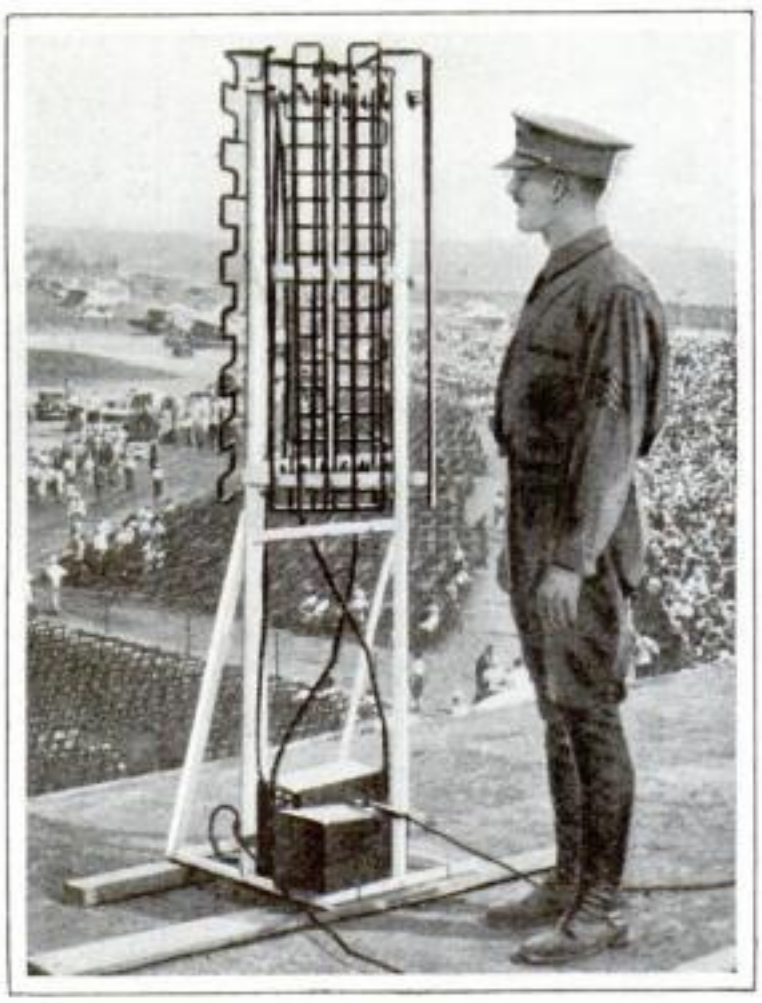
NEON GAS LIGHTS GUIDE TRAFFIC IN THE AIR

RED and green beacons, made of neon lights, recently provided the Curtiss-Reynolds airport at Chicago with a novel "stop-go" system for regulating airplane traffic. They were installed on the roof of a hangar, where they were plainly visible to pilots flying over the airport.

When races and other activities made it dangerous for an incoming plane to land, the red beacon signaled a warning. A green light signaled that it was safe to land.

The red and green beacons were of slightly different form but in all essentials they were exactly alike. The red neon gas tubes were in the form of spirals which were wound about larger tubes of clear glass. These were arranged about a circular mounting The green gas tubes were straight, and, as the photograph shows, they were mounted in banks, giving the apparatus the appearance of a gridiron.

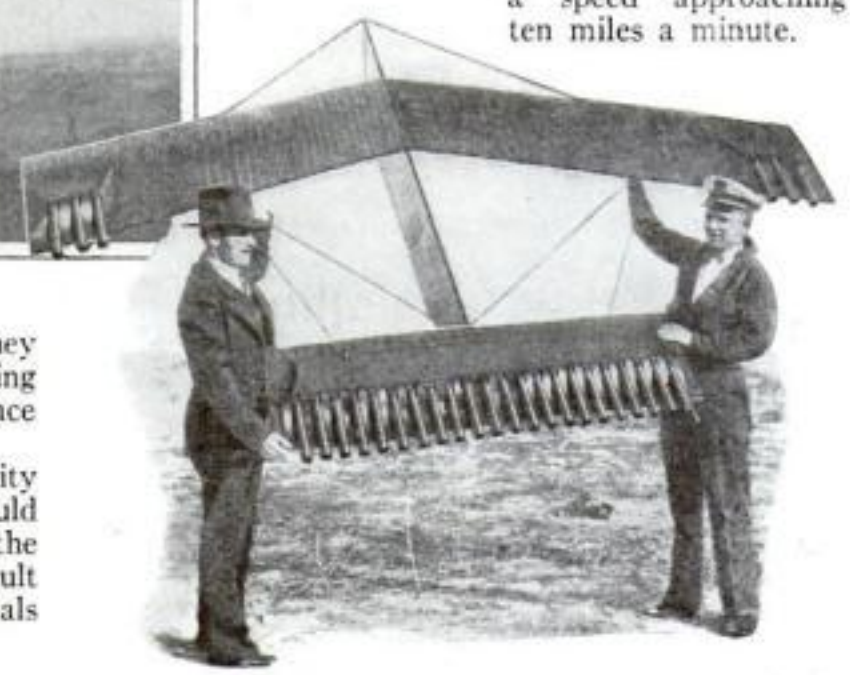
So great was the visibility of these lights that they could be seen distinctly even in the brightest sunlight. As a result no misunderstanding of signals occurred.



Green and red neon gas lights, mounted on top of hangar at Chicago, controlled airplanes landing or taking off.

EXPECT HIGH SPEED OF ROCKET-DRIVEN PLANE

IF THEIR calculations are correct, a barrage of rockets will soon send a ten-foot model plane whizzing through the air. Maurice Poirier and Franklin L. Wallace, of Los Angeles, Calif., built the model and if it flies they will attempt to build a full-sized craft on the same plan. They predict that the rockets will give the model a speed approaching ten miles a minute.



Model of rocket-driven plane which its inventors say will whiz through air at ten miles a minute.

ARMY'S MYSTERY PLANE PASSES SPEED TEST

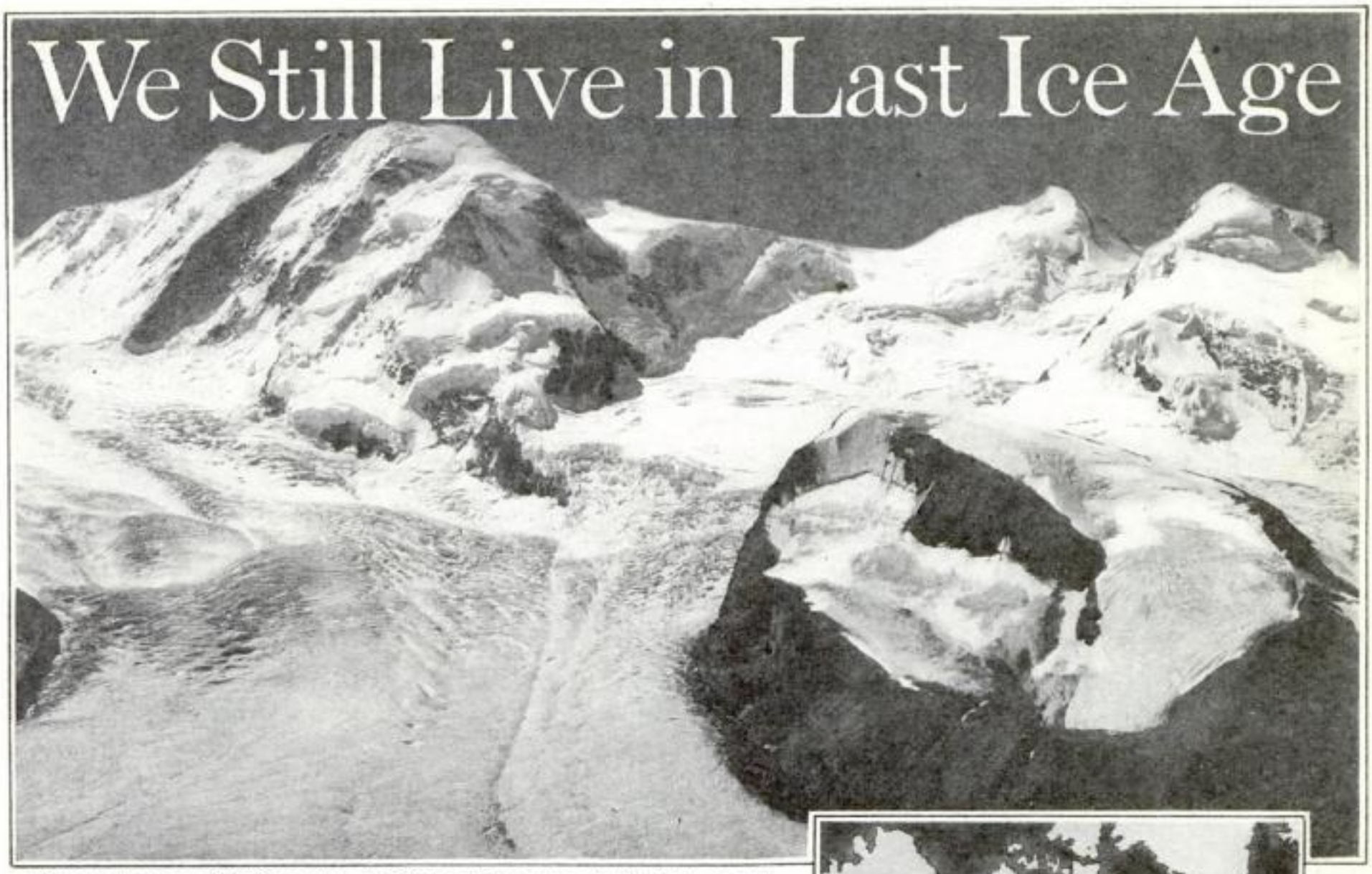
A HUGE Fokker bombing plane that can fly at 170 miles an hour was accepted the other day by the United States Army after it had met all required tests. This sensational speed makes the "mystery ship" faster than any military plane except the tiny single-seater pursuit ships.

Known as a "flying wing" because its motors are concealed in the wings to lessen air resistance, the craft is a new surprise in aerial warfare. It is intended especially for dropping bombs, taking photographs, or reconnoitering far behind the enemy lines, where its speed will enable it to play tag with enemy craft. The fast ship carries a crew of three in separate cockpits—a pilot in the center and machine gunners at front and rear.

The plane was designed by Army Air Corps engineers in conjunction with Fokker experts. One of its surprising features is the fact that it has abandoned air-cooled motors and is powered with two 600-horsepower engines, water-cooled. When in flight the landing wheels are drawn into the fuselage by a separate electric motor.

Army's new plane, with engines hidden in the wings, makes 170 miles an hour in test flight.

We Still Live in Last Ice Age



Between the crags of Alpine peaks, this Swiss glacier moves slowly down to melt in the foothills. Much of America and Europe looked like this in the Ice Age.

This map shows how the latest Ice Age pushed its way south, covering Canada and part of this country.

Frigid Era in World History Lingers While Ice Caps Hide the Poles—This Article Tells You How New Facts Were Found and What They May Mean to You

By CHARLES FITZHUGH TALMAN

THROUGH training and habit, most of us have come to think of the Ice Age as a dim period hundreds of thousands of years ago, when gigantic ice fields a mile deep slid from the poles, smothered the bleak and frigid earth in a deadening embrace, and drove our primitive ancestors into caves for protection.

This mental picture has been proved to be only partly correct. In one of those superb pieces of scientific detective work which, every now and then, suddenly advance our knowledge of the world we live in, geologists not long ago uncovered evidence showing that the last Ice Age is a comparatively recent period in the earth's history.

As a matter of fact, it has not ended yet. We are now living in the Ice Age, and it is not at all certain that we are experiencing its final stage. The present era may be one of those alternating stretches of mild world-weather, known as interglacial periods, that will be followed by another frozen epoch as severe as the last one.

However, it isn't necessary to lay in an extra supply of coal against that emergency. The earliest date prophesied for the next icy visitation is that fixed by Dr. V. Nordmann, a Danish authority, who says it may come in another 20,000 or 25,000 years (P.S.M., June '29, p. 157).

Geologists believe that three or four ice ages have struck the earth at irregular intervals of about 300,000 or 400,000 years. It is the last one that the majority of us call "the" Ice Age. Scientists usually refer to it as the Quaternary Ice Age. It spread over the globe a blanket of ice that attained a maximum area of some 12,000,000 square miles—one fifth the total land surface of the earth.

To date, only about half of this titanic ice mass has melted away. The rest remains in the polar regions and in high mountains elsewhere. The Antarctic alone is covered with an ice field measuring more than 5,000,000 square miles. It actually is a million square miles larger than was the tremendous ice sheet that covered North America in the Pleistocene period more than half a million years ago.

Until Antarctica and Greenland are set free, Dr. A. P. Coleman, professor of geology in the University of Toronto, Canada, said the other day, we cannot claim that the Ice Age is entirely over. Fossils show that the earth, during most of its history, has been free from ice sheets even in the polar zones. Now, about 6,000,000 square miles are ice-covered. This means that we have only half emerged from the last Ice Age.

WHEN did we begin to emerge? Many efforts have been made to calculate the time that has elapsed since the ice withdrew from places in this country and elsewhere. These estimates were based upon measurements of certain natural processes, such as the cutting of the gorge at Niagara, that are supposed to have gone on at a fairly constant rate ever since the land was freed of ice.

The figures thus arrived at were rather

Here are the varves, banded clays, laid down by melting ice. From these Montana clays the rate at which glaciers melted in America is measured.

From Ernst Antevs' "The Recession of the Last Ice Sheet in New England," American Geographical Society's Research Series No. 11, New York.

conflicting. Generally, they ran into the tens of thousands of years. Recently, however, a method of timing late Ice Age events has come into use which, for the first time, gives us definite dates for some of these occurrences in Europe and ultimately may do so for other parts of the world.

These dates turn out to be strikingly recent. Part of central Scandinavia, for example, still was buried completely under ice as lately as 7,000 years before the Christian era, when humanity already had emerged from barbarism in southern and western Asia.

THE site on which Stockholm, the capital of Sweden, now stands was laid bare of ice only 10,000 years ago. The ice left southern Sweden about 13,500 years ago. It withdrew from the southern shores of the Baltic about 18,000 years ago. There are no definite figures for the time it began to retreat from its most advanced position in central Germany, but if the rate of movement was the same at that period as at later stages, the withdrawal began about 21,000 years before our time.

These figures, by the way, also fix, with a fair degree of accuracy, the time of the settlement of northwestern and central Europe. For the migrations from Asia must have followed closely the retreat of the ice fields, occupying the land almost as soon as it was freed of ice and mantled with the first green of vegetation.

How were these dates obtained? It was Ragnar Lidén, one of a party of student assistants of Baron Gerard de Geer, distinguished Swedish geologist, who discovered the new Ice Age "calendar." To realize the significance of Lidén's discovery, it is necessary to recall how his chief prepared the way for him.

FROM regions of perpetual snow, vast bodies of ice called glaciers still move slowly down mountain slopes or valleys. Many lakes near these glaciers and fed by streams from them receive deposits of sediment. They are coarse, thick, and light-colored in summer, when the ice is melting rapidly, and fine, thin, and dark-colored in winter, when there is little melting. These deposits form distinct layers in the clay banks that, centuries ago, were the beds of lakes at the edge of the retreating ice sheet. De Geer was the first investigator to study these annual layers or clay bands. He called them "varves," while the clays in which they occur are said to be "varved."

The varves vary considerably in thickness from one year's deposit to another, and similar series of thick and thin layers are found in widely separated localities. By matching sets from different places and by noting the positions occupied by corresponding layers in each vertical series, De Geer was able to determine the rate at which the front of the ice sheet retreated, just as it is possible to tell a tree's age from its rings.

The geologist found that, in Sweden, the average speed of recession was about one mile in nine and a half years. With the aid of a group of students he then made an elaborate survey of the varved clays of his native country. Thus he worked out a detailed chronology for the retreat of the Scandinavian ice sheet.

These were the first steps in the creation of the Ice Age calendar. But, while the dates of this chronology were quite definitely determined with relation to one another, they were not related to human history. It was left for Lidén to find the missing link in the chain of evidence revealing the actual time at which the ice began to disappear.

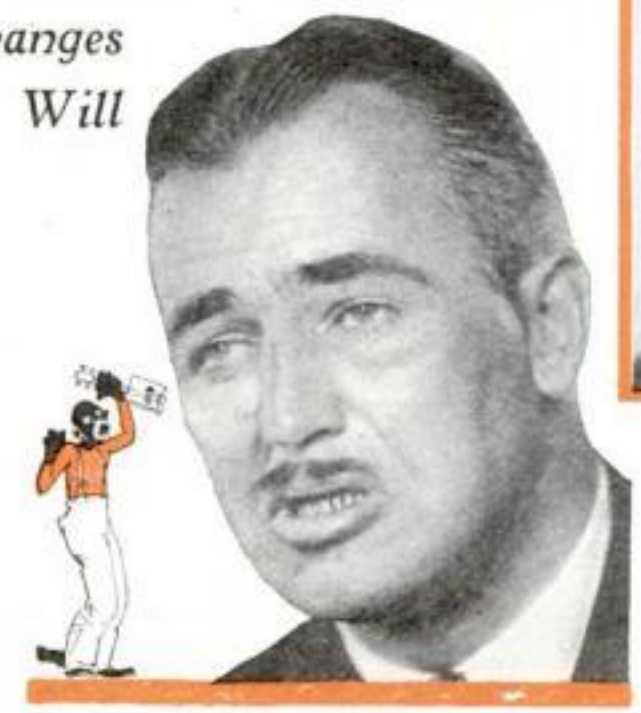
THIS is how it came about: In central Sweden, Lidén discovered a place where varves had continued to be formed in a river delta by the annual melting of winter snows after the ancient ice sheet retreated, down virtually to the present time. Thanks to this remarkable find, which perhaps could not be duplicated anywhere else in the world, geologists now are able to assign actual "B.C." dates to some of the more recent European Ice Age events.

It is an almost universal custom, even among geologists, to speak of the Ice Age in the past tense. Thus De Geer, in working out his time scale, found it necessary to adopt a certain date for the "end" of the Ice Age. This he placed at 8,700 years ago. Events that happened after that date are described as "postglacial," or "after the ice."

This particular date fairly well represents the time when the ancient ice sheet in Scandinavia broke up into mountain glaciers of the modern type. It is a convenient point from which to reckon because it is marked in the varve series by an exceptionally thick band, formed when a huge lake, previously dammed by the ice, broke loose and flooded the country. *(Continued on page 142)*

As the ice sheet moved south it leveled off hills and gouged out valleys, picking up immense quantities of rocks of all sizes. When it melted, these rocks were dropped and this big one was left on Long Island.

Phil Cook Mikes His Whole Show at Once



Versatile Radio Actor Changes Voice and Expression at Will

WITH nothing to help him but a microphone, his voice, and his imagination, Phil Cook, popular radio entertainer, projected fifteen different characters, each a distinct personality, in a six-minute skit during a recent special radio broadcast program over a large network.

This performance, hailed as a feat unequaled in radio history, was the culminating exhibition of a new technique developed by Cook for the one-man shows he puts on the air.

In common with thousands of other Americans of all ages and walks of life, I had been listening to Cook's remarkable solo work. Like them, I was impressed by the versatility of the man who blows the breath of life into the troupe of amusing personages—rural, negro, Irish, Italian, "Dutch," cockney English, and the rest—that people his sketches. Like them, I wondered how he did it, and how he managed to keep apart the various types, usually six or seven in one act, without ever "missing a trick." After hearing his fifteen-character radio playlet, my amazement was such that I decided to find out.

By JOHN E. LODGE

For the benefit of those who may not have heard Cook, let me explain that every weekday morning and every weekday evening except Saturday he broadcasts a fifteen minute program, consisting, in his own words, of "a mess of home-Cooked foolishness." But this description does not fit the performance. The feature of the "show," both morning and night, is a "comic strip," in which a number of astonishingly lifelike "funny-paper people," all of them portrayed by Cook himself, enact continued stories.

In the morning, he presents the adventures of two darkies and Tony, an Italian. At night, he gives the story of Eddie and Abner—a tough city-boy and a rural lad—in which "Pop" (Abner's father) and John, an old, small-town station agent, figure prominently. Besides, a host of incidental characters and even animal pets flit in and out of the skits. Cook also imitates ventriloquist's dummies, plays several mus- *(Continued on page 140)*

Phil Cook, who broadcasts a great many different characters and keeps each a distinct personality, does it by means of a new radio technique which he developed after years of study.

Flops of Famous Inventors

Edison, Ford, De Forest, and Bell Patented Strange and Useless Things

By GEORGE LEE DOWD, Jr.

DROPPING gently to the ground like a giant autumn leaf, a Pitcairn autogiro, or "windmill plane," landed at the Newark, N. J., airport one afternoon a few weeks ago. More than 8,000 persons saw it descend almost vertically and then touch the field without rolling a foot.

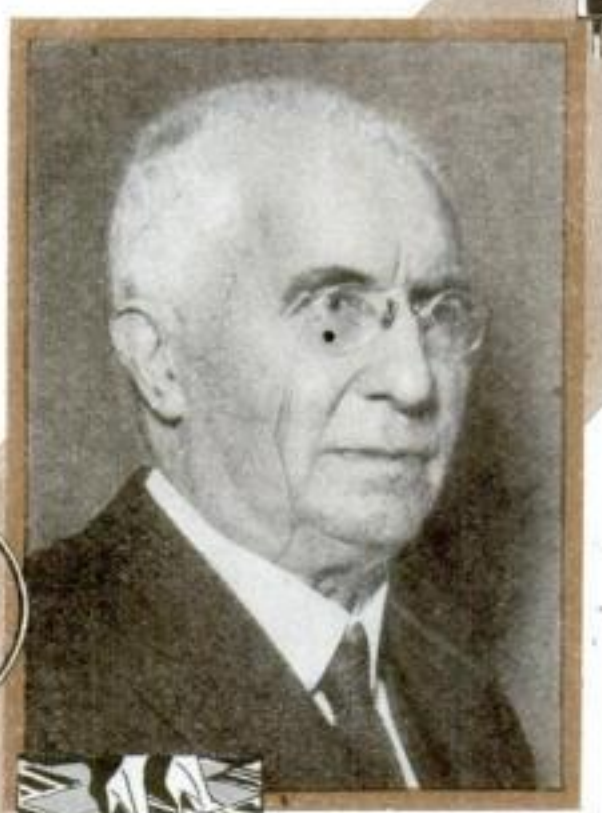
The crowd, however, had not come merely to see the autogiro perform. It was attracted chiefly by the presence on the field of Thomas A. Edison, who visited the airport for his first sight of a "flying windmill."

After expressing his admiration of the machine and his amazement at what it could do, Edison told airport officials that he once had invented a helicopter.

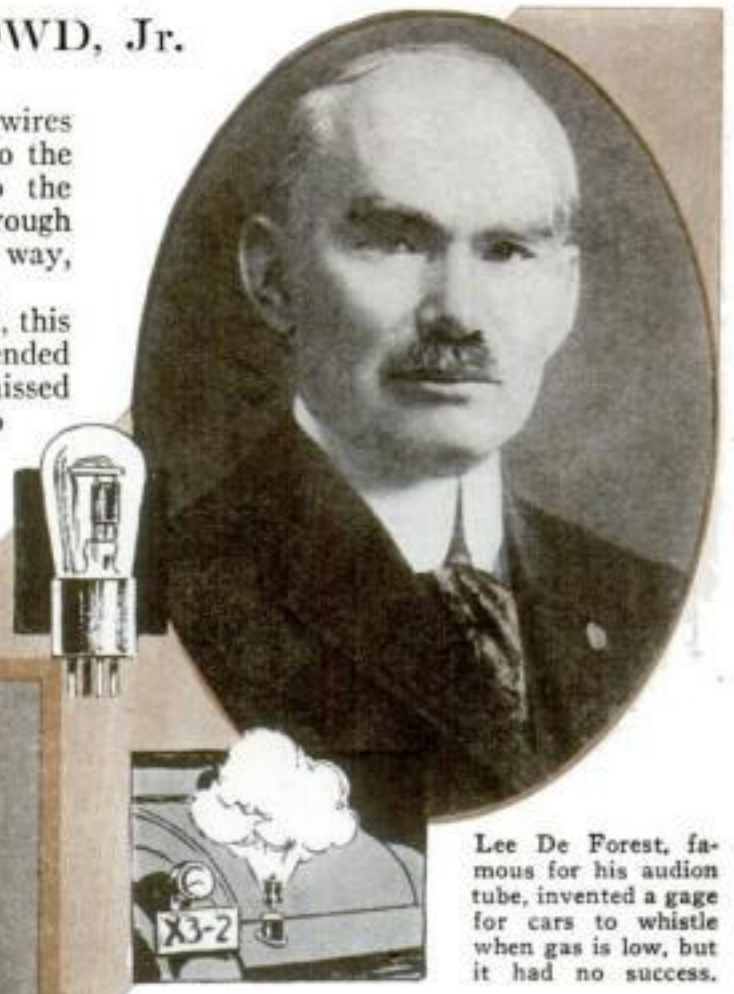
That was in 1908, long before the first measurably successful vertical flying machine had been designed, and just twenty-two years before a prominent aircraft concern built its first helicopter. In 1910, a U. S. patent was issued on the invention.

But Edison's device never flew and it never will. It consisted of a number of box kites, attached, fore and aft, by two strands of piano wire to a disk around a central pole. Piano wire also connected the rear of each kite to a lower platform on which was mounted a gasoline engine. In theory, this motor was supposed to rotate the upper disk and the lower platform as a unit, swinging the kites about the central axis as a boy swings a tin can on a string. The wires running from the rear of the kites to the lower platform were adjustable so the angle of the kites in their passage through the air could be changed and, in that way, govern the helicopter's lifting power.

Queer though it would have looked, this flying merry-go-round might have ascended skyward like a lark, had not Edison missed two vital features. He neglected to provide a means of preventing the motor from turning itself instead of rotating the kites. Secondly, he forgot to include a rigid member by which the rotating force could be transferred to the kites. Hence, if the motor started, the shaft would rotate and immediately wind the wires around itself, thus pulling in the kites and reducing the whole contraption to a tangled mass of wire and fabric.



Emile Berliner, who invented the microphone for telephone use, originated a flooring that no one used.



Lee De Forest, famous for his audion tube, invented a gage for cars to whistle when gas is low, but it had no success.

Henry Ford wasted his time inventing a rig to tilt hospital beds and found no market for it.

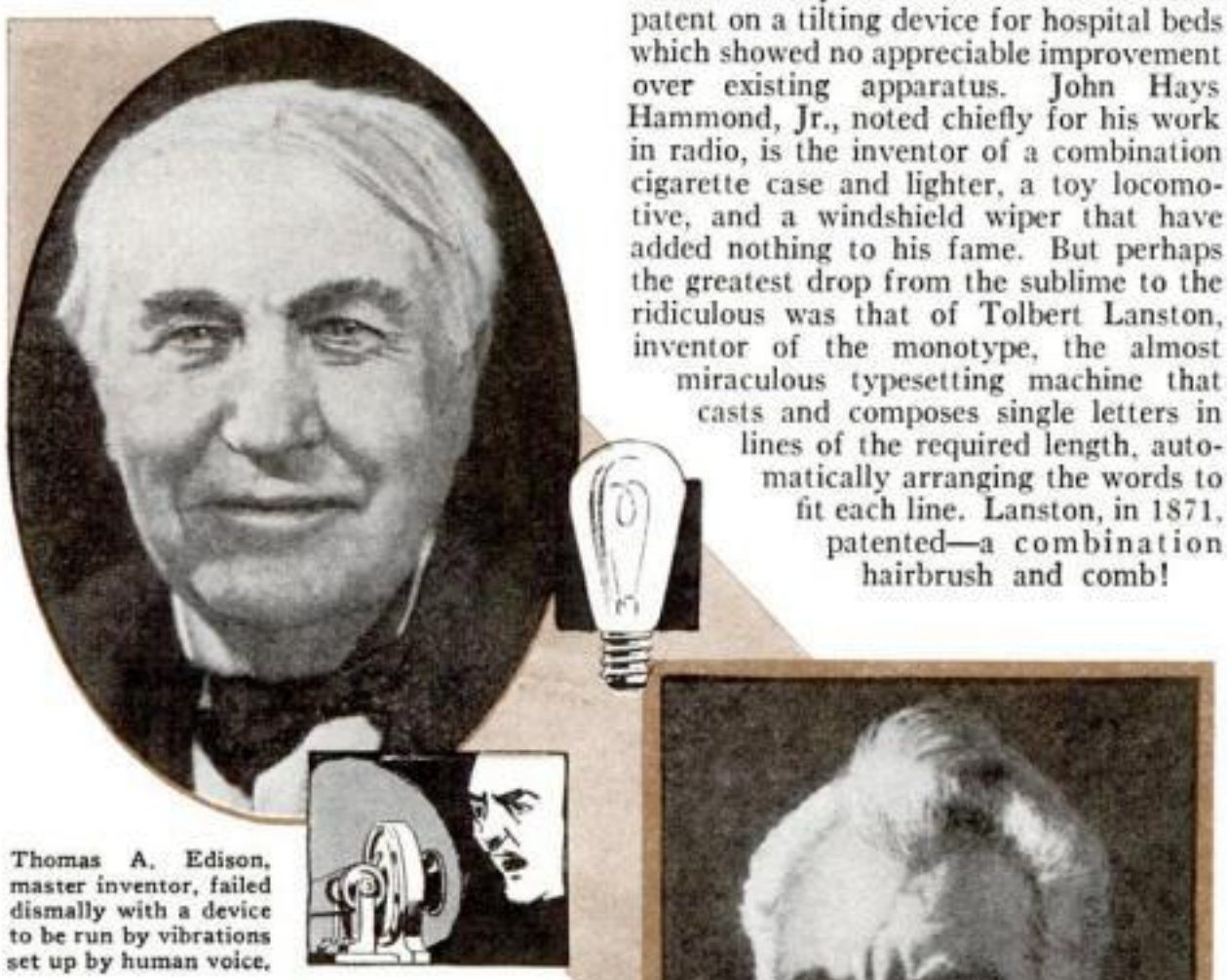
THE fact that the man who gave the world electric light, motion pictures, talking machines, and the Edison storage battery was responsible for this utterly useless device should encourage inventors whose first attempts have failed. It furnishes convincing proof that even outstanding genius is not infallible. Nor was the helicopter Edison's worst fiasco. For sheer inutility and misdirected effort, his "vocal engine" is easily last on the list of his 1,100 patents.

About the time he devised this strange apparatus, which was patented in 1878, Edison must have been appalled by the vast amount of energy going to waste in the flood of oratory unleashed daily in this talkative world. At any rate, it was an attempt to harness the energy of our vocal sound vibrations, thus:

A DIAPHRAGM behind a mouthpiece was connected by a small link with a ratchet so constructed that the motions of the diaphragm, caused by the voice vibrations, would turn a wheel. To this was attached a grooved pulley, around which a belt could be placed. The belt could be applied to the driving of a small machine.

The device never worked for the simple reason that the vibrations created by one human voice do not possess sufficient energy to set in motion anything worth moving. A radio loudspeaker, working at full capacity, produces sound waves with an energy of approximately one watt. A brass band playing as loudly as the lungs of its members will permit would generate about an equally negligible quantity of power. Now, an ordinary electric light bulb is rated at forty watts. Imagine how many persons, shouting at the top of their voices, it would take to drown out forty brass bands and you have an idea of the number of men who would have to yell into Edison's vocal engine to light a single lamp!

But Edison is not the only famous inventor who, at times, has descended from the pinnacle of genius to become, for the nonce, a fallible mortal. A search I recently made of the records of the U. S. Patent Office, in Washington, D. C., revealed that the names of some of the men who have patented useless, impracticable, unmarketable, trivial, and even downright silly inventions virtually constitute a bluebook of America's greatest inventors.



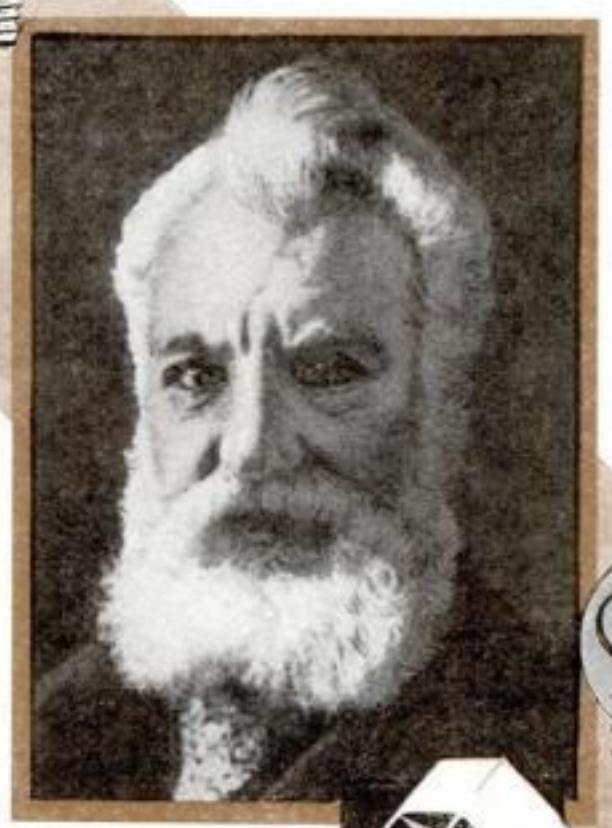
Thomas A. Edison, master inventor, failed dismally with a device to be run by vibrations set up by human voice.

Inventors who have devoted endless labor and much time and money to devices that later proved impracticable or unpopular may well take comfort from these random examples of failures, near-failures, and trivialities which, in addition to Edison's two "flops," I found filed at the Patent Office under illustrious names:

ALEXANDER GRAHAM BELL, inventor of the telephone, in 1904 patented a piece of aircraft, somewhat in the shape of a flying beehive that could fly as a kite but was without value as an airplane. Emile Berliner, whose invention of the microphone lifted the telephone out of the toy stage, and whose lateral wave groove record did the same for the phonograph, took out several patents on parquet flooring, the squares of which had matting on top! So far as is known, no floor ever has been covered with this material. Hudson Maxim, famous for his smokeless powder, ordnance, gun silencers, range finders, and automobile torpedoes, patented an unsuccessful steam cooker and a game of skill, resembling chess, which nobody plays.

Lee De Forest, inventor of the audion tube and "father of radio," only five years ago patented an automobile gas tank gage that blows a whistle like a peanut roaster when the gas gets low. The shrill voice of this contraption has not been heard in the land. C. Francis Jenkins, a prolific inventor, responsible for one of the systems of television broadcasting, in 1919 unsuccessfully attempted to revive an antiquated type of automobile tire casing patch. He also is the inventor of a lawn mower and of an airplane that never has flown.

ELIHU THOMSON, one of the world's foremost inventors, perhaps most famous for his induction motor, patented a device to take the unpleasant odor out of automobile exhaust gases. That was thirty-three years ago, and our roads and streets still are filled with noxious fumes. Henry Ford in 1921 took out a patent on a tilting device for hospital beds which showed no appreciable improvement over existing apparatus. John Hays Hammond, Jr., noted chiefly for his work in radio, is the inventor of a combination cigarette case and lighter, a toy locomotive, and a windshield wiper that have added nothing to his fame. But perhaps the greatest drop from the sublime to the ridiculous was that of Tolbert Lanston, inventor of the monotype, the almost miraculous typesetting machine that casts and composes single letters in lines of the required length, automatically arranging the words to fit each line. Lanston, in 1871, patented—a combination hairbrush and comb!



Alexander Graham Bell, telephone inventor, patented a kitelike aircraft that worked as a kite but was worthless as an airplane.

Why did most of these inventions "flop" despite the fact that their creators were men of outstanding mechanical ingenuity? In some of the cases, notably the Edison helicopter and vocal engine, the devices were faulty, and the only explanation seems to be that even the smartest of men have their "off days." This also was the trouble with Bell's flying beehive, which consisted mainly of a large number of small kite units cleverly fitted together. In its construction, however, the inventor did not take into account several of the most important factors since proved essential to airplanes, such as the proper curving of the wing surface. Jenkins' tire patch was another example of imperfect design. It was a steel-studded leather boot to repair tire blow-outs. The studs were put in the leather to take out the wear, but Jenkins forgot that they also would take the smoothness out of automobile riding.

Structural defects are by no means the only reason why inventions fail. An inventor of any versatility who never made a worthless or impracticable invention, who never misread the public pulse or misgaged popular demand, would have to be a man endowed not only with inventive genius but with the commercial ability of a merchant prince and the foresight of a prophet.

AN INVENTION, for instance, may be perfectly sound and useful and yet fail to catch the public's fancy. That was the fate of De Forest's whistling gasoline gage, Lanston's curious comb-and-brush combination, and Berliner's matting-covered parquet floor. On the face of it, it would seem that there must be a demand for a gas tank gage giving audible warning when the tank is getting empty instead of the usual visible indication by means of a dial that so often is not watched. Still, motorists did not want it. Lanston's innovation in toilet articles might have proved a timesaving device to many men, but they laughed at it, and I, for one, don't blame them. Berliner's parquet floor also may have had mechanical merit and might have proved a boon to the housewife. However, she did not like its looks, and that was the end of it.

Berliner, incidentally, made two disastrous excursions into the field of aeronautics. At one time he, too, invented a helicopter that never left the ground. Later, he "improved" it by building it around an umbrellalike parachute. Since it never rose, there was scant danger of its falling, and this contraption, too, found a niche in the inventors' gallery of "busts." Berliner's son, Henry, redeemed the family

(Continued on page 146)

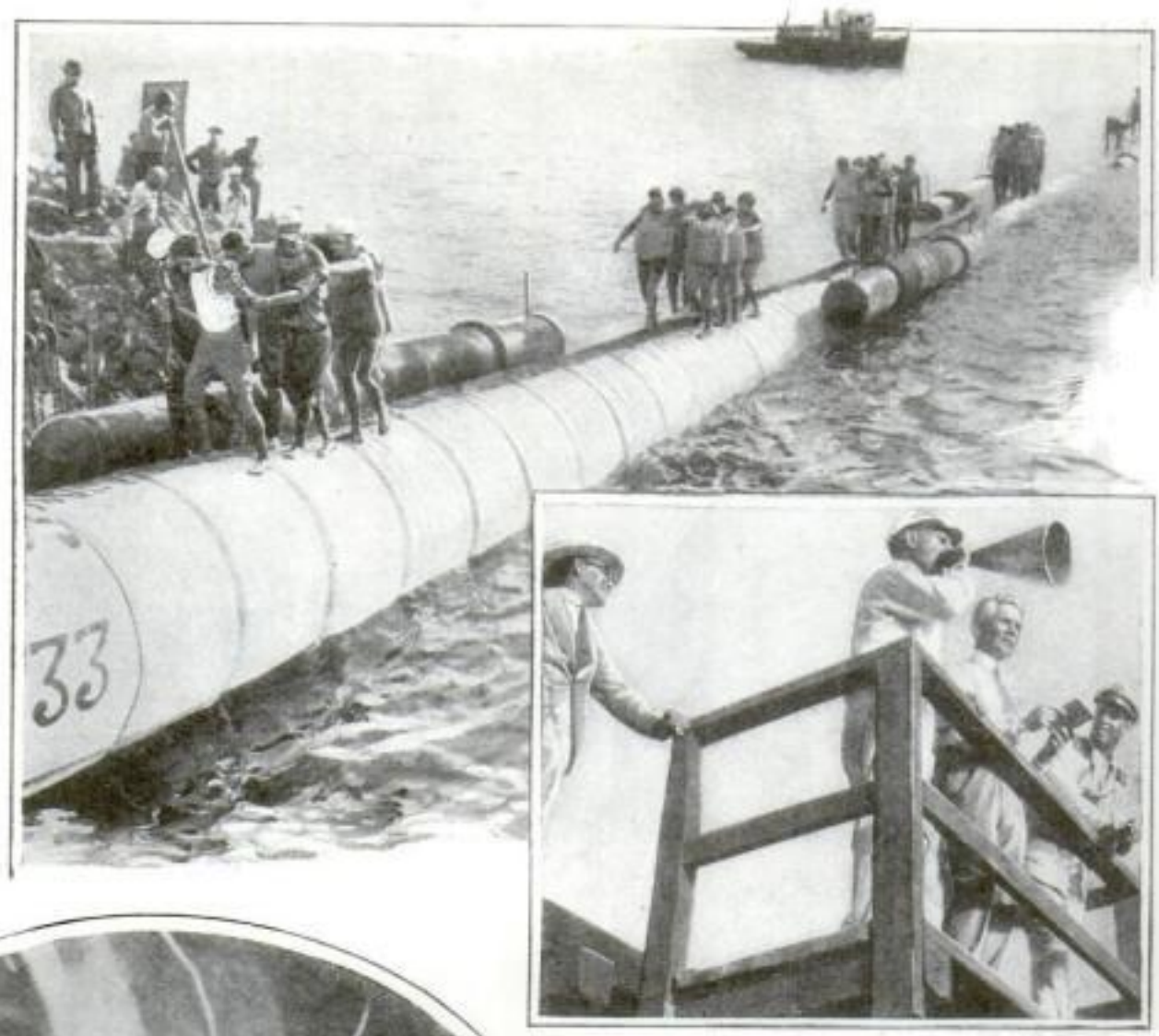
C. Francis Jenkins, of television fame, developed a patch for auto tires that no one wanted.

CLAUDE'S POWER TUBE LAID DEEP IN SEA

SWIMMERS loosened stopcocks, and an enormous tube of corrugated steel nearly six feet in diameter and more than a mile long sank gently beneath the waters of Matanzas Bay, Cuba. At last Professor Georges Claude, noted French physicist, had succeeded in launching a shaft to bring free power from the tropic sea. Two other similar tubes, each costing thousands of dollars, lay lost at the bottom of the ocean. Two months were required to build the third tube and eight days were spent in sinking it and making the connections.

A few hours after the launching, the shore end was connected to the first experimental station that Professor Claude has built to test his dream of tropic power. Here surface water, warmed by the Gulf Stream, flashes into steam without being heated further when it is drawn into a vacuum chamber. Cold water, brought from a quarter of a mile beneath the surface of the sea through the long tube, condenses the steam after it has passed through a turbine four feet in diameter, and preserves the vacuum. Thus Professor Claude uses the difference in temperature between the two sea levels as a "heat machine" to run the turbine and generate electricity.

In is first tests, the turbine developed power enough to light forty 500-candlepower lamps. An observer taking temperatures, as in the photograph at the right, found that water came up the big pipe as cold as 56° F. Now Claude proposes larger power stations of the same type.



Third and successful effort is made to sink a tube in the sea. Claude, center in inset, watches operations.

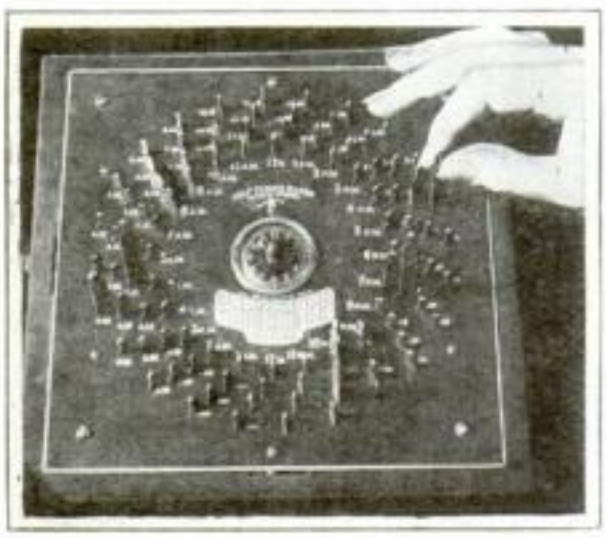
AUSTRALIAN FLASHLIGHT SET OFF IN HARTFORD

A FLASHLIGHT picture of the opening ceremonies of a radio exhibition in Melbourne, Australia, was recently taken from Hartford, Conn. Hiram Percy Maxim, president of the American Radio Relay League, pressed a telegraph key in the Connecticut city, igniting the flashlight powder in Melbourne.

The hook-up was by direct wire from Hartford to Montreal, Canada, and from there by wireless to Australia.

AUTOMATIC RADIO CLOCK TUNES IN STATIONS

A RADIO set that operates itself has recently been perfected in New York. The control board is fitted with a clock that can be set to start or stop the instrument automatically at any hour of the day or night. The same device may be set to bring in any chosen stations by means of metal tabs inserted in the proper slots.

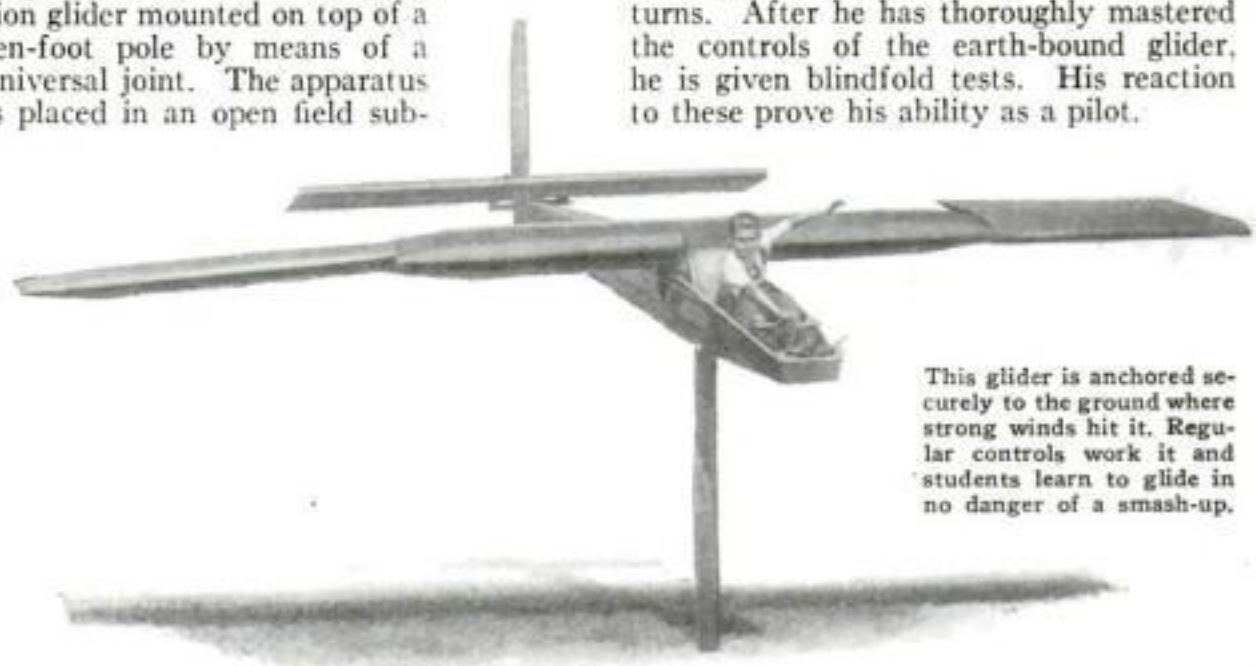


This clock can be set to turn on or shut off any radio station at any desired hour.

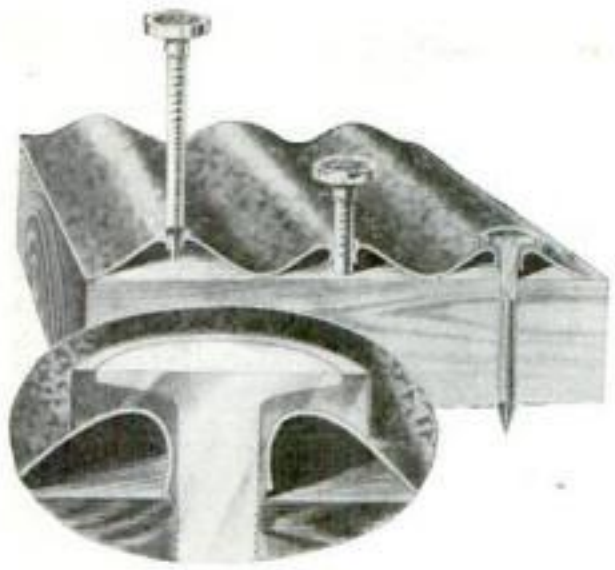
LEARN TO FLY IN ANCHORED GLIDER

A TRAINING device for glider pilots that is fixed to the ground but which responds to its controls in the same manner as a glider in flight has been perfected in Los Angeles, Calif. It is a regulation glider mounted on top of a ten-foot pole by means of a universal joint. The apparatus is placed in an open field subject to strong currents of wind.

The prospective pilot gets into the "captive glider" and manipulates the controls exactly as if he were flying. He noses up or down, banks in either direction, or turns. After he has thoroughly mastered the controls of the earth-bound glider, he is given blindfold tests. His reaction to these prove his ability as a pilot.



This glider is anchored securely to the ground where strong winds hit it. Regular controls work it and students learn to glide in no danger of a smash-up.



NAIL, WITH LEAD, SEALS HOLE IN ROOFING

ROOFING materials have a tendency to rust around nailheads due to the presence of moisture at that point. Now a nail has appeared on the market that is said to make such rusting impossible. The nail has beneath its head a shoulder of lead, and as it is driven in and hammered home, the lead flattens out, seals the opening, and is expected to prevent the entrance of any moisture. The new nail is made with a sharp point so that it can be driven through sheet steel roofing without first punching a hole. The harder the nail is struck the tighter the sealing is said to be.

TROPICS SHIP "ICE" TO SAVE NORTH'S FOOD

"ICE" to keep things cool in the northern part of the United States is now being shipped by sea from the Quebrache district, Mexico, to New York City. The tropics supplying a means of preserving food in northern climates is a decided reversal of form. Not long ago ships, going south for perishable foods, were loaded with vast stores of ice. That is no longer necessary.

Solid carbon dioxide, in compartments insulated against heat exchange by twelve inches of cork board, is being landed in New York. In order to take care of this "dry ice," specially designed warehouses, which are insulated with heavy boards of cork, have been constructed near the wharf.

"Dry ice" from Mexico, shipped to New York, is stored in warehouses insulated with cork.

ELECTRIC LAMP IS BLOWN OUT, LIGHTS WITH MATCH

BLOWING out an electric lamp or lighting one with a match sounds like conjurers' tricks. However, each is possible now if one has the proper appliances.

Dr. E. E. Free, consulting engineer of New York City, has developed special contacts mounted in a tube with a mouthpiece similar to that of a telephone transmitter. Blowing in this tube forces the contacts apart and breaks the circuit, so extinguishing the light.

The lighted match trick was created by the Westinghouse Lighting Institute of New York City. A photo-electric cell, concealed in the base of a lamp fixture, is actuated by the light of the match and this in turn closes an electric circuit, thereby turning on the light.

This electric lamp lights with a match. A photo-electric cell in the base is the thing that really does the work, as it responds to the light of the match, closes a circuit turning on current.

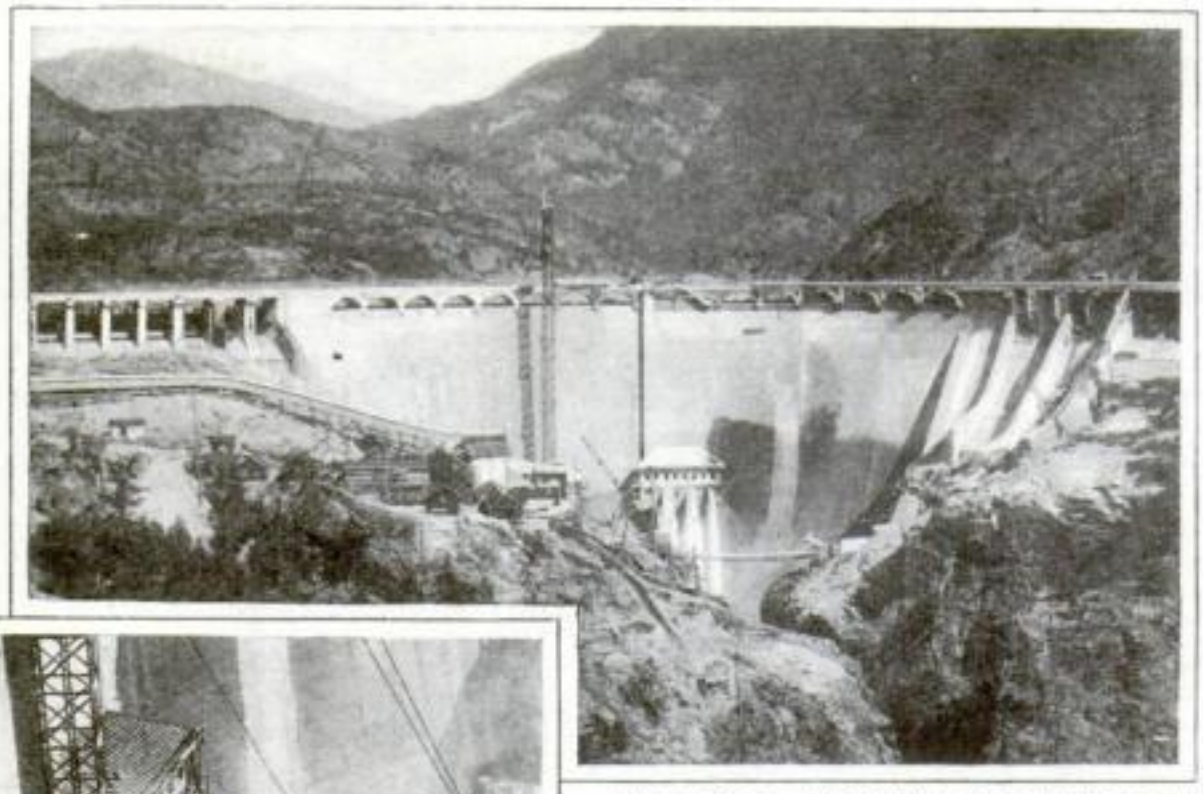
With a mouthpiece attached to a tube leading to contact plates, designed by Dr. E. E. Free, of New York City, an electric light can be blown out. The air forces the plates apart, breaks the circuit, and the light goes out.

RUSSIAN CLUBHOUSE IS OF GLASS

IT IS apparent that the workingmen of Soviet Russia will have to stop throwing stones. The picture below shows their new home, recently opened in Moscow. The walls of the structure are composed almost exclusively of glass, which in large part is perfectly transparent. Parts of the walls, however, are merely translucent and designed only to admit light. Such glass was used wherever the weight made necessary a thickness so great that transparency was impossible or prohibitively expensive.

The building, which in general design resembles a fort or blockhouse, is large enough to accommodate hundreds of workers, who will make it not only their scene of recreation, but to all intents and purposes their home as well. It is equipped with baths, gymnasiums, reading and rest rooms and a restaurant. It was built by the government, is strictly communistic in management, and its use is limited to those workers who are in good standing with the Soviet administration. The cost of its maintenance is provided for in the municipal budget. Similar workingmen clubhouses are planned for many other Russian cities in which the communist ideas are dominant. Their construction, at present, however, is delayed, pending the success of Moscow's experiment, along with an expression of desire on the part of the workers.

A workingmen's clubhouse, recently opened in Moscow, Russia, is built almost exclusively of glass, much of which is fully transparent.



Above, the new Diablo Dam, and, at left, the spillway furnishing 225,000 horsepower to run turbines.

BIG NEW DAM SUPPLIES 225,000 HORSEPOWER

SEATTLE, Washington, has just completed the first of two mighty dams that are to provide power for a municipal owned hydroelectric plant, now building. This power plant, exclusive of dams and waterways, will cost approximately $12,000,000 to construct.

The new dam, highest completed arch dam in the world, is 389 feet high, 1,180 feet in length, 140 feet thick at the bottom, and forms a lake behind it that is six miles long. It will deliver, through its spillway, 225,000 horsepower, which will be used to drive the world's biggest turbine engines. After running through the spillway of the Diablo Dam, the water flows ten miles down the Diablo Canyon to another power house, where it is used for the second time to generate power.

This newly finished Diablo Dam is in one of the least accessible parts of the Cascade mountains, only a few miles south of the Canadian border. At present no roads reach it, the only means of transportation to the site of the dam being a municipal owned trolley.

Beyond Diablo a second and mightier dam is to be built at once. It will be 500 feet high and will bank up waters to form a lake approximately twice the size of Diablo Lake. Its spillway will open directly into the artificial lake below it. The entire system of dams and power plant will cost $25,000,000. The building of Diablo Dam, alone, cost $5,000,000.

The dams are built on the Skagit River, in the midst of some of Washington's most magnificent scenery. When and if roads are built to the new dams, a section of rare beauty will be opened to tourists. Diablo, designed to conform to the general contour of the terrain, does not mar the view, while the deafening roar of its spillway adds the effect of a mighty artificial waterfall.

Three years were required to build Diablo, and it is now expected that another three years will be necessary to put the system in full working order.

THERMOMETER CLINGS TO OUTSIDE OF WINDOW

WHEN winter winds boom around the house, how cold is it outside? That question can now be answered without so much as sticking your nose out window or door. A thermometer is now on the market which attaches by means of two suction cups to the outside of the window pane. Reading of the temperature is plainly visible from within. The cups are so powerful that no ordinary force will dislodge the instrument.

Outside temperature can be read on this thermometer held to pane by suction cups.

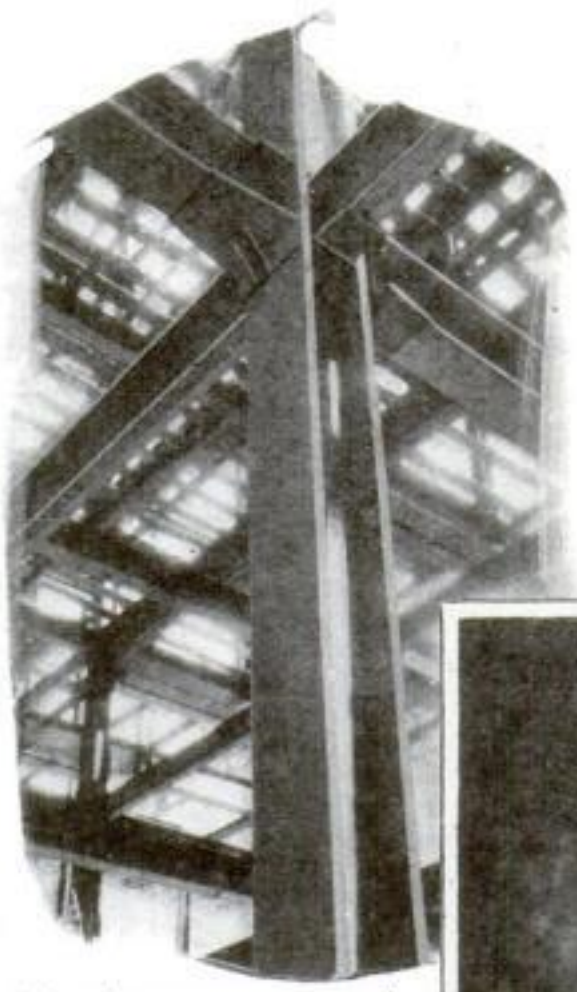
USE ARC WELDING IN SKYSCRAPER

IN Dallas, Texas, a nineteen-story skyscraper is rising and no flaming rivets are being driven into its steel joints. Only a while ago, a rivetless steel frame office building would have seemed impossible.

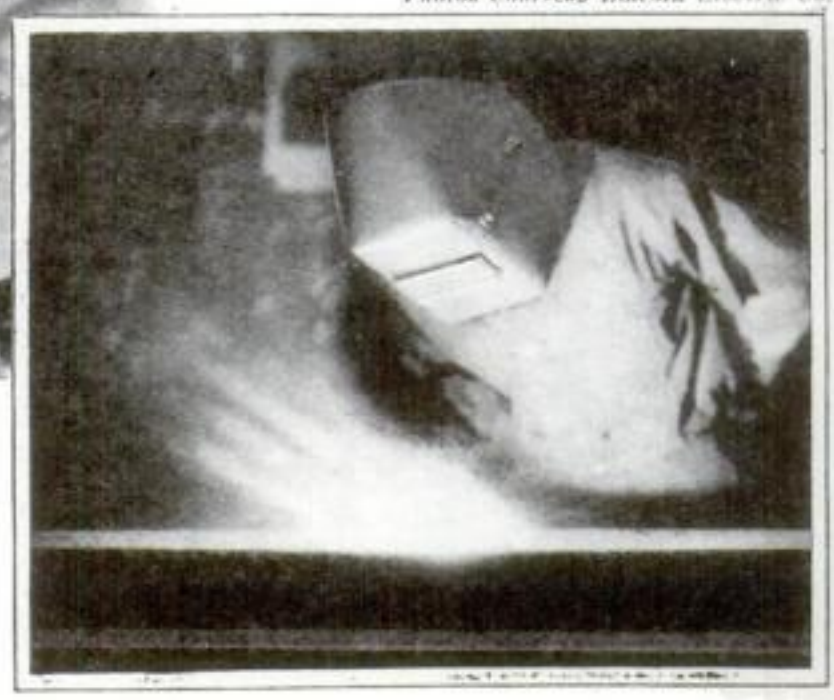
However, electric engineers have worked out, and are rapidly perfecting, an arc welding system that has been used with satisfactory results. It is believed that the Dallas building is the tallest in which arc welding has been used exclusively.

The advantages claimed for this system (P.S.M., Dec. '29, p.30) lie in the greatly decreased weight the beams are required to carry, lessened cost of material, and increased speed of construction.

Photos Courtesy Lincoln Electric Co.



This nineteen-story structural steel building, Dallas, Texas, was electric arc welded throughout. Said to be the highest structure built by this method.



At right, a close-up of workman using the arc welding apparatus. Protective helmet and clothing are made necessary by sparks.

New York's skyline from a tower of the Brooklyn Bridge today (above) and fifty years ago (below). Note the many sailing ships at the docks in the lower view.

NEW YORK SKYLINE NOW AND FIFTY YEARS AGO

NEARLY half a century lies between the two views of New York City's skyline shown in the pictures above. The two photographs were taken from the same point—a tower of the famous Brooklyn Bridge. The upper one was made only the other day and the lower one is over forty-seven years old.

Architects, engineers, and modern machinery seem literally to have raised Manhattan Island out of the waters surrounding it. In the lower view, Brooklyn Bridge, opened in 1883, was just being built. Note how the buildings at that time seemed to crouch low on the island, only here and there an occasional church spire throwing itself defiantly skyward.

In the upper view the buildings have fairly freed themselves from the land and apparently have become decidedly air-minded. In the immediate foreground is the office building at 120 Wall Street. Looming gigantic behind it is the Bank of Manhattan Company building, and far to the right of it appears the famous Woolworth Tower.

Still farther to the right, and beyond the Manhattan end of Brooklyn Bridge, is the Municipal Building. Note how the present height of the buildings almost completely obscures the distant west shore of the Hudson River, which in the lower picture is plainly visible across Manhattan.

CAMERA SAVES BEAUTY OF COLOGNE'S DOME

MOISTURE and climatic changes are rapidly disintegrating the old dome of the Cathedral of Cologne on the Rhine. Every effort has been made to preserve the famous parts, but the destruction still goes on. In order that posterity may have some idea of the beauty of the structure, Professor Hamann, connected with the Art Exploring Institute of Marburg, Germany, is making a series of snapshots of the highest and most weather-worn parts of the dome.

To do this, the erection of special scaffolding for himself, his assistant, and the camera was necessary. In many instances, access to desirable vantage points was difficult and the work highly hazardous.

Professor Hamann, of Marburg, Germany, photographs the dome of Cathedral of Cologne.

EXHIBIT BRAZIL'S FLEXIBLE STONE

Flexible stone from Brazil is exhibited in Philadelphia. Note how its own weight bends it down.

SOMETHING new in the shape of stone may now be seen at the Academy of Natural Sciences, Philadelphia, Pa. The stone, which the Academy obtained from Brazil and has placed on exhibition, is flexible. It is described as in every respect genuine stone, but it can be easily bent without breaking in half.

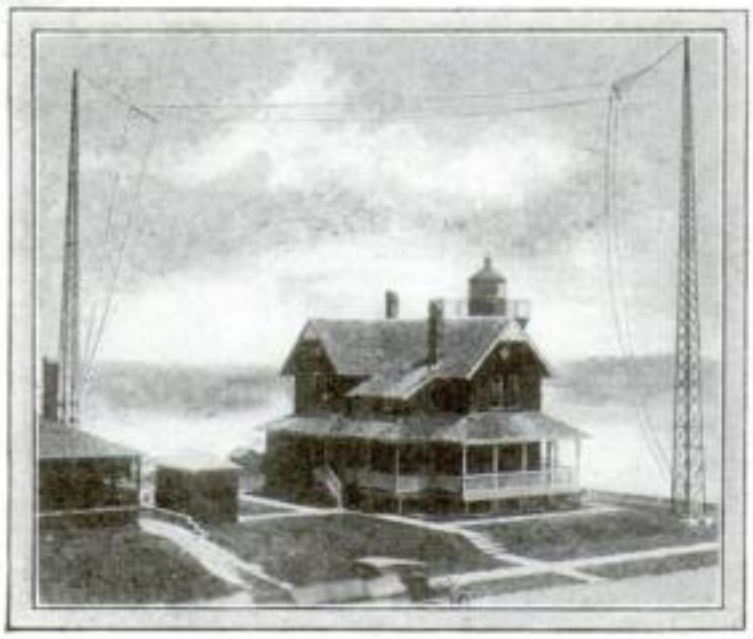
Holding the stone by the two ends, its weight bends it down in the middle, but when laid flat it resumes a smooth surface. Not as heavy as granite, it will break under any considerable weight.

The stone on view is a thin slab, and it is reported to be in that condition when quarried. It is believed that a similar stone may be found in North Carolina, where there are geological conditions almost exactly the same as those surrounding the strange material in Brazil. Efforts to find it in that state will be made. No practical use for the stone has, as yet, been discovered.

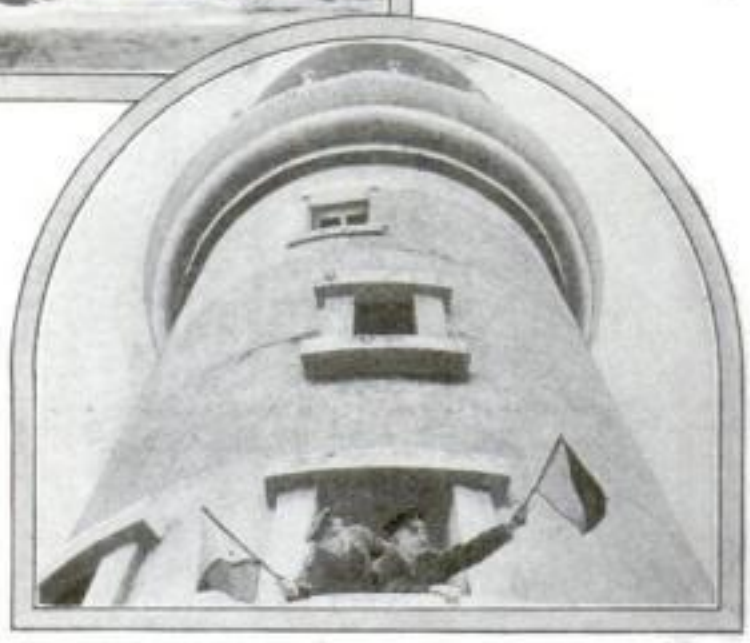
Lighthouses of Strange Designs, with Radio to Help, Guard Ships of Air and Sea

Down on Cape Florida this lighthouse still throws its beacon out to sea. It is over two hundred years old and is the oldest one on shores of the United States.

On a giant rock rising out of the waters off the Oregon coast, stands the Tillamook Rock lighthouse, one of the most exposed. Waves wash over its 140-foot crag.

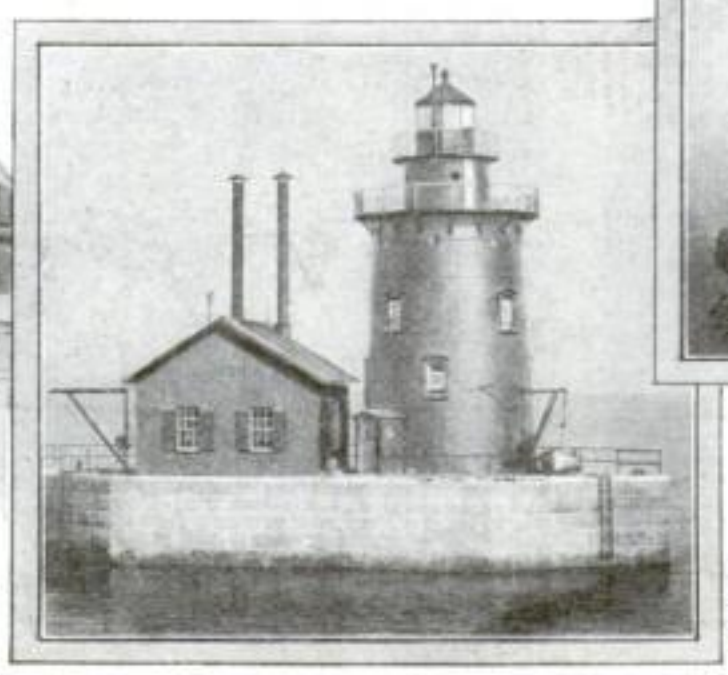


Sea Girt light station on the New Jersey coast looks much like a private house, but back of it can be seen the light tower, while stretching above it is the radio antenna which picks up calls for help and warning messages.



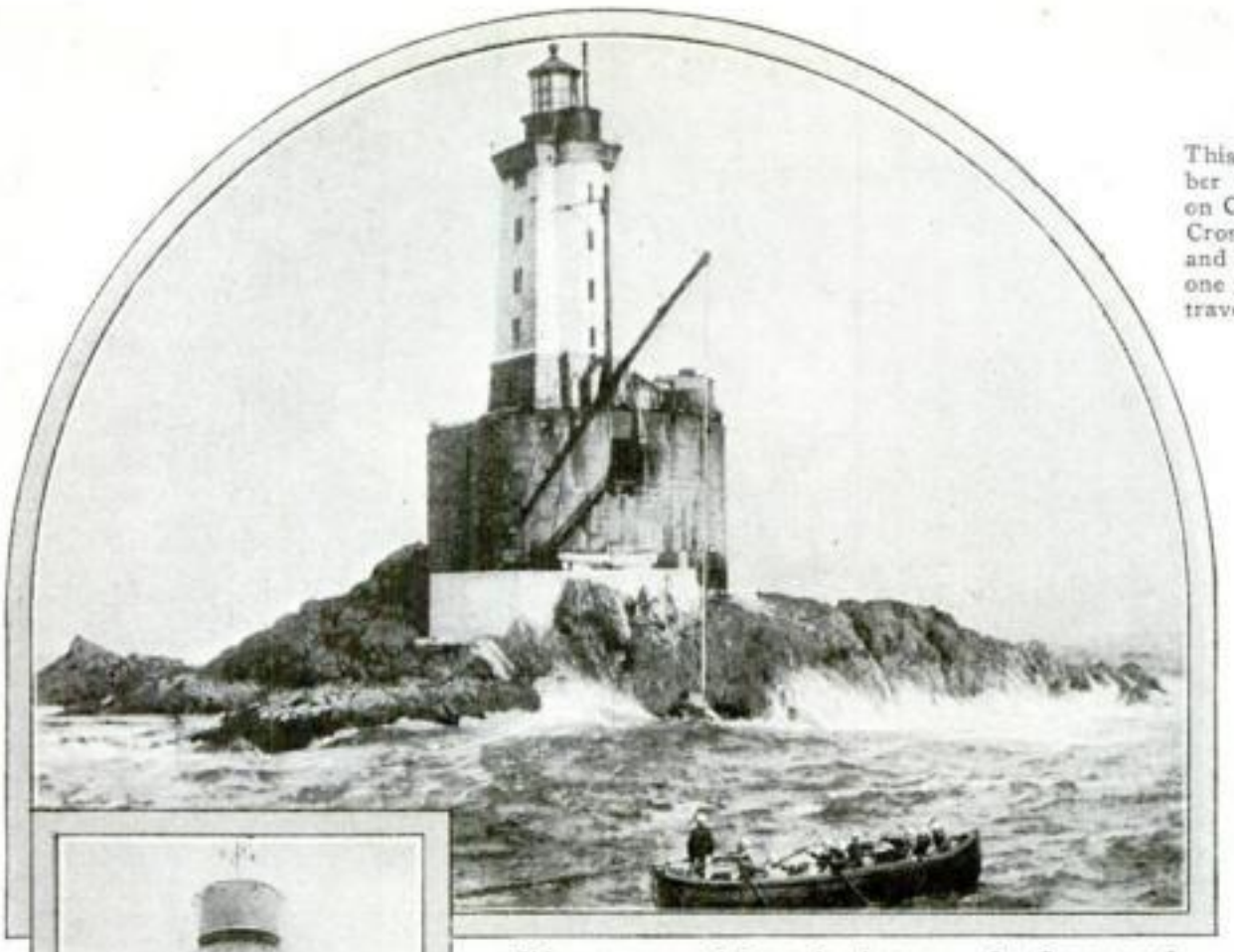
Waving signal flags from a window in the famous Grace Darling lighthouse on Farne Island, off the Northumberland coast of England. This great light guards a course particularly dangerous because of fog and rocks.

This smokestack lighthouse, which rises like a great chimney behind the house in the foreground, is at Barnegat, N. J., and is only one of the many signal towers standing in America that are interesting because of their shape and height.

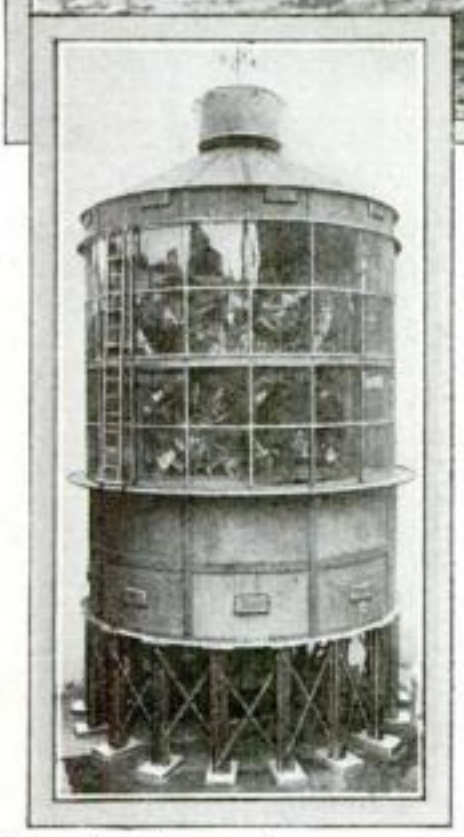


Point Reyes Light station, California, looks dumpy in the picture above, but in reality it stands on a rocky ledge that rises almost 300 feet above the sea.

Even inland waterways need their beacons to guide ships and at the left is the Detroit River light station that stands in Michigan, near a tricky channel.

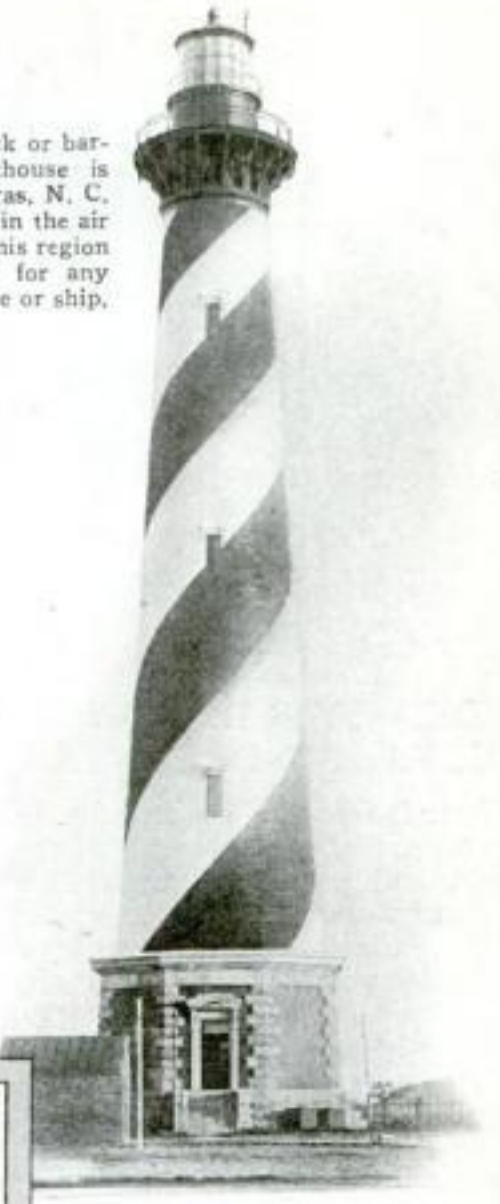


Ships are warned from the dangerous St. George reef, off the California coast, by the light from a station that, pierced with windows, looks like an apartment house.



To guide air travelers, this lighthouse has been built on Mount Afrique, near Dijon, France. One of the most powerful in the world, its light can be seen for many miles.

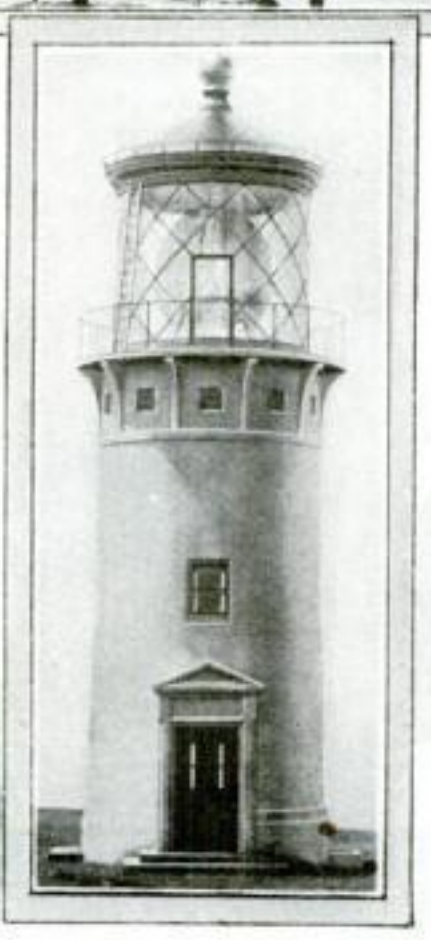
This light station, in appearance much like a bungalow set on stilts, warns ships of Bluff Shoal on North Carolina's shoreline.

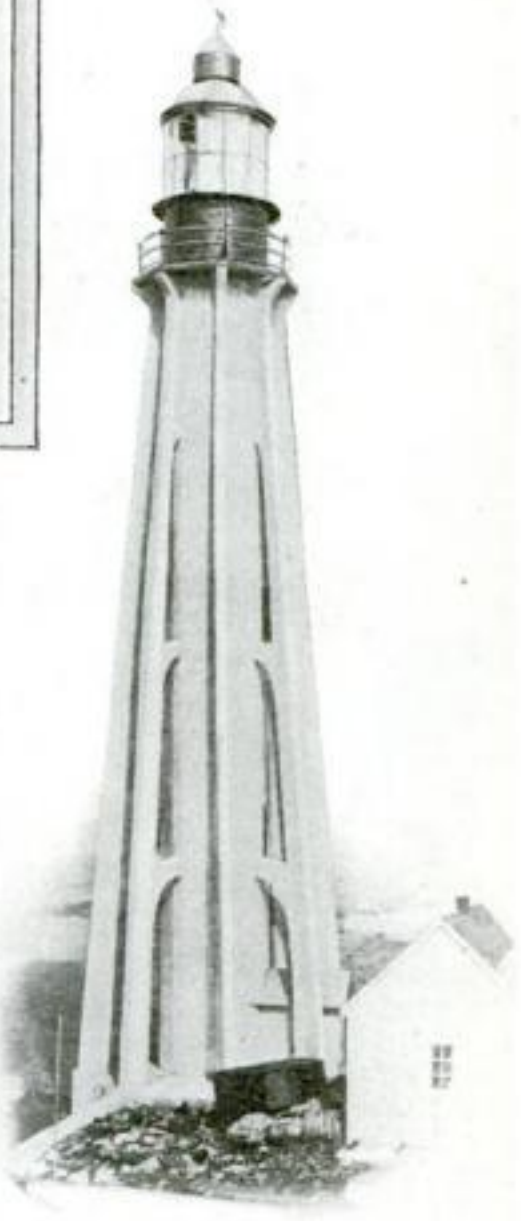


This candy stick or barber pole lighthouse is on Cape Hatteras, N. C. Cross currents in the air and sea make this region one of danger for any traveler in plane or ship.

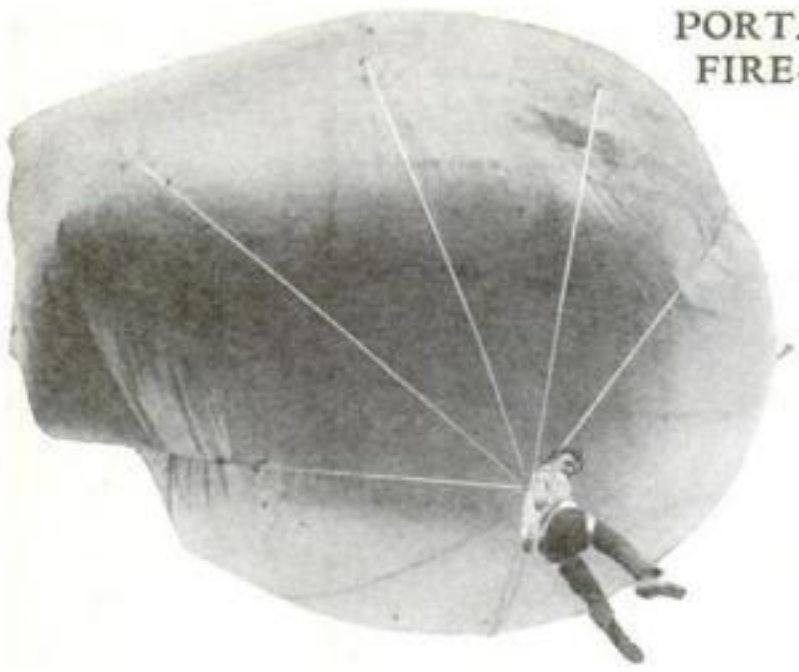
Waves wash around the base of the Minots Ledge, Mass., light which rises from sea.

At right, the squat little lighthouse that is on Kilauea Point, Hawaii, to guide the Pacific ships.





Sentinel before Quebec is this strangely designed lighthouse that throws its warning rays across the St. Lawrence River.



AIDED BY BALLOON, MAN LEAPS HUNDRED YARDS

WHAT is the world's record for the running broad jump? Maybe Jack Cope, balloonist and parachute expert, holds it, because he can jump a hundred yards or more at a time. Not unassisted, of course; but with his partially filled balloon, such feats are easy for him.

Cope inflates his balloon until it is within a few ounces of being able to lift him. Then it is released and as it slides along before the wind, he leaps into the air and is borne forward several hundred feet at a time. The sport is not dangerous if the field is level and free of obstructions.

ELECTRIC POWER PLANT IS CARRIED AROUND

DESIGNED especially for field work at a distance from a suitable electric source, a portable power plant has been developed by the Westinghouse Electric and Manufacturing Company. The unit, complete, weighs 120 pounds and is operated by a one-cylinder gasoline engine that develops one and one half horsepower at 4,000 revolutions a minute. It is air cooled and mounted on pipe skids to assist in moving it. The speed is regulated by an automatic mechanical governor.

PORTABLE LIFT TO SAVE FIRE-TRAPPED VICTIMS

LADDERS as means of escape from a burning building may be replaced by a portable elevator invented by M. E. Hayman, a member of the Portland, Ore., fire department. In case of a fire, the elevator is rushed to the scene and by hand or motor power it is raised in front of the desired window. A means of escape is thus provided free of the trembling uncertainty with which a novice trusts himself to a swaying and vibrating ladder.

Firemen can use it, also, to carry them to a point of vantage from which to attack the flames. Obviously, the apparatus could be used by painters or carpenters in place of scaffolding. A large size portable elevator can be raised, according to its inventor, to a height of 200 feet.

The elevator collapses by means of sidepieces, with groove and tongue that fit, which slide into each other and are operated by cables that wind or unwind around a series of drums permanently located in the base. The smaller sizes can be operated by a hand crank on the base, but those designed for use by the fire department will be mounted on a truck and raised and lowered by a motor geared to the crank. Simplicity of design and freedom from unnecessary parts keep the weight of the elevator so low that, even with the largest size, its transportation from place to place is easily accomplished.

Portable elevator raised to rescue woman from upper story. At right, drawing shows pulleys and grooved sidepieces to operate lift.

ROBOT BREATHER FILLS LUNGS IF MUSCLES QUIT

PATIENTS suffering from paralysis of the respiratory muscles are now being treated in an artificial breathing machine invented by Dr. Philip Drinker of the Harvard School of Public Health.

As shown in the photograph above, it is a boxlike case entirely inclosing the body with the exception of the head. Raising and lowering air pressure causes expansion and contraction of the chest in accurate simulation of ordinary breathing.

LEFT TURN CAR SIGNAL HAS MIRROR ATTACHED

REAR vision and left turn signals are combined in a new accessory for trucks, buses, and automobiles. The device is attached by means of a bracket to the left front door post. It consists of a movable mirror that can be swung to give rear vision while going up or down a hill and a left turn arrow signal. Operated from the driver's seat, the signals can be made without lowering the window.

The photograph above shows the signaling device installed on a motor truck.

NOVEL CARDS TEACH CHILDREN MUSIC

CHILDREN become familiar with musical scales and chords through a recently introduced set of playing cards. They are marked with chords of the musical scales, such as "B major" and "G minor," instead of the conventional numbers and suits. Games similar to solitaire, cassino, and rummy may be played with them.

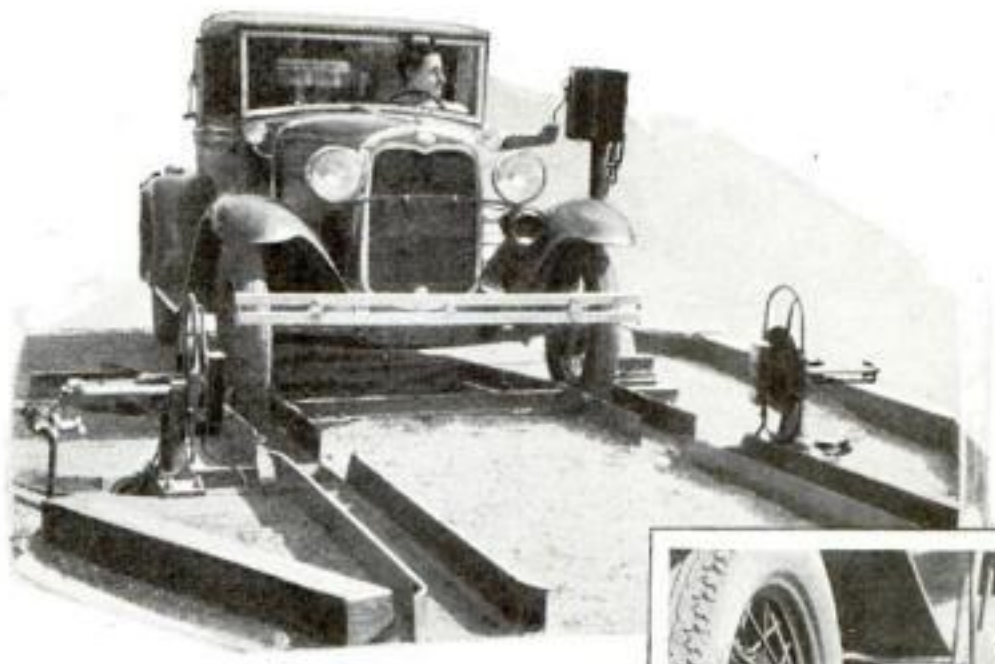
The cards have naturally evolved into two decks of fifty-two cards each and a joker, which is used to produce "harmony" or "discord" under the rules of the game.

Scales and chords are taught children with these cards upon which are musical symbols.

THIS MECHANICAL ROBOT WRITES ITS ANSWERS

THIS "mechanical writing girl" answered in writing questions put to her at a recent New York radio exhibition. A German invention, the "robot" worked on the same principle as the "telautograph," or electric writing machine widely used in business houses for the instant transmission of written messages. A concealed operator worked the controls.

Recently exhibited at a radio show, this mechanical robot answers, in writing, all questions asked of it.



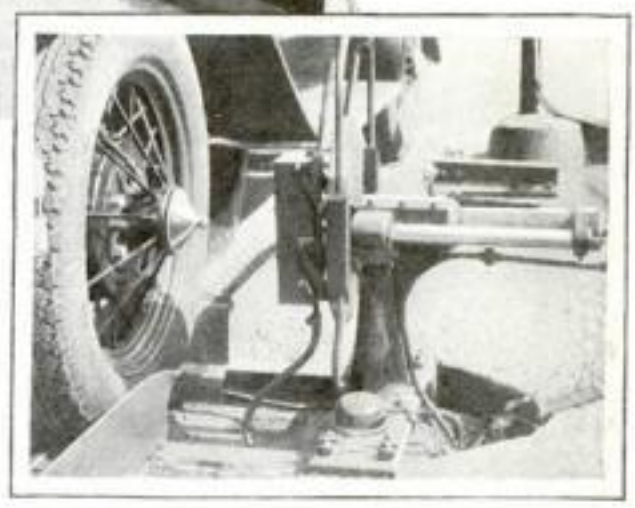
At left, the driver pulls lever which determines the amount of air the automatic tire inflator puts in car's tires. Below, air nozzles advance and form connection with special hub caps on wheels. When desired pressure is reached machine shuts itself off.

TIRE INFLATOR WORKS WITHOUT HUMAN AID

PUTTING air in the tires of your car should be a pleasure instead of a nuisance, according to Ellis E. White, of Los Angeles, who has just perfected an automatic tire inflator. To get air in the tires of his car, the driver need not get out from behind the wheel.

When his tires need air, he drives up a runway at the service station. He passes a box with a lever and a graduated scale, and with a touch of his hand he sets the lever to the number of pounds pressure he wishes in his tires.

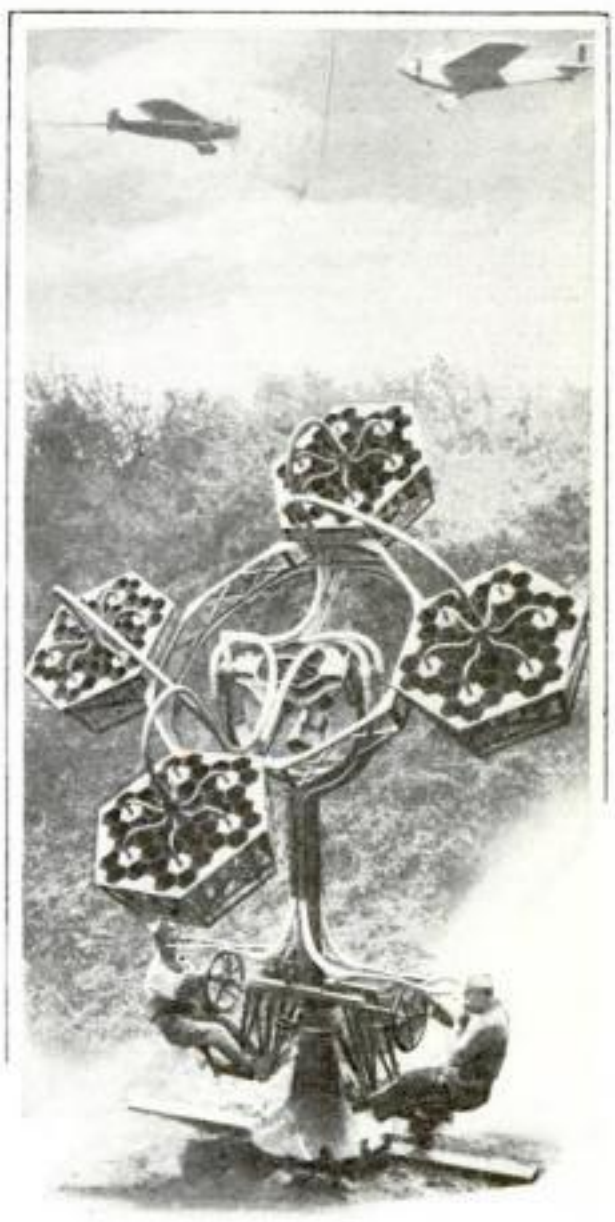
At a certain point on the runway his wheels drop into a groove and close an electric contact, setting the inflator in action. Air nozzles advance from each side and press against special connections on the wheel's hubs. Air flows into the tires. When the tire is full a bell rings and the air is shut off. To use the novel service, a car must have special air nipples that fit over the hub of his car's wheels and have a pipe connection to the tire valve to complete the operation.



BIG MIKE DETECTS AIRPLANES

ODDLY suggestive of a four-leaf clover, a queer-looking machine recently tried out in France proved its ability to detect the approach of enemy airplanes in wartime.

Within the "leaves" of the cloverlike device are supersensitive microphones that pick up the hum of the distant plane's motor. Two men, sitting on elevated saddles, operate controls that swing the listening device about to focus it in any direction.

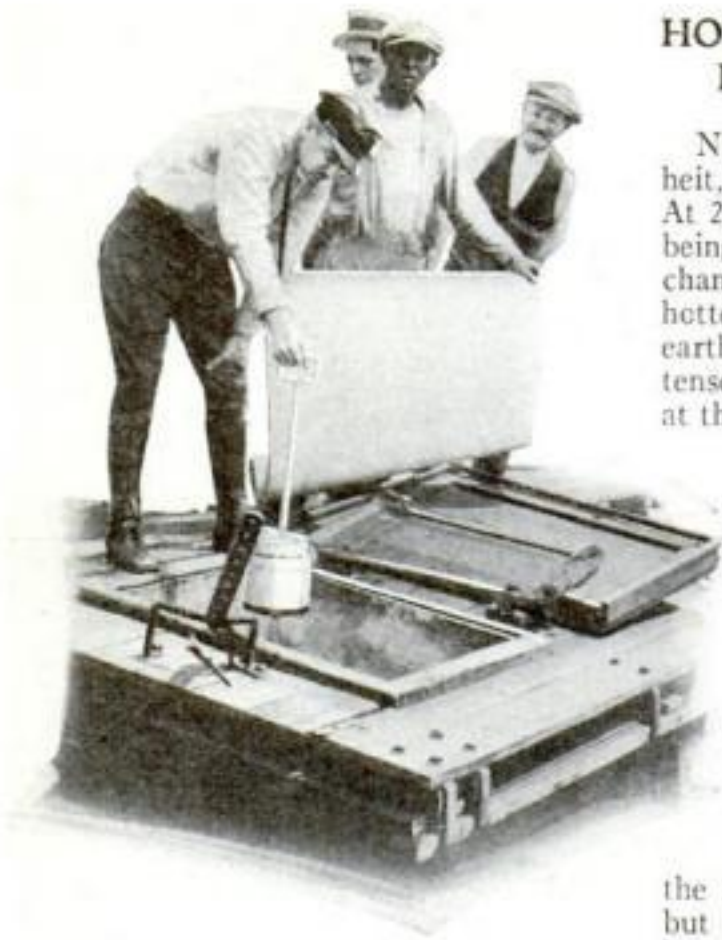


Supersensitive microphones hidden in this queer device are used to detect distant planes.

AIRPLANES STOP PRAIRIE FIRE

BLASTS from airplane propellers halted a prairie fire recently, in a field bordering a California airport. When the advancing flames threatened thousands of dollars' worth of planes and equipment, a fleet of aircraft was backed up to the flames. Brakes held the planes while a blast of air from the propellers checked the blaze so it could be beaten out.

The exciting incident, gave student flyers an experience outside the curriculum of most aviators. Instructors stood on the alert, during the fire-fighting, to give the signal for the planes to release their wheel brakes and fly to safety if the flames broke past the line of fighters; but the fire was successfully extinguished before it became necessary.



JAPANESE BEETLES NOW KILLED IN CARLOAD LOT

JAPANESE beetles enter this country with shipments of bananas. In order to combat the pest by killing it before it can become active, field workers of the United States Department of Agriculture are now going after them before the banana car is unloaded.

By the new method fruit is fumigated with cal-cyanide gas by forcing the gas through ice bunkers into the refrigerator cars. The picture shows the manner in which the gas enters the car.

HOTTEST SPOT ON EARTH HITS 900,000 DEGREES

NINETY degrees in the shade, Fahrenheit, makes an uncomfortably hot day. At 212 degrees water boils, and no human being can live in boiling water. What chance would one have, then, if hit by the hottest temperature ever developed on earth—one of 900,000 degrees? This intense heat, far greater than that of the sun at the surface, has been produced between the electrodes of an electric arc in a vacuum tube by R. Tanberg of the Research Laboratory of the Westinghouse Electric and Manufacturing Company. The heat is determined by the action of gaseous atoms of metal vaporized from the electrodes. No thermometer could measure such heat, which probably exceeds anything outside the center of some of the biggest stars. In the old-fashioned arc light there was a spot in the end of the carbon where the temperature rose to 10,000 degrees, but nothing approaching the tremendous heat measured by Tanberg has hitherto been found on the earth.

At a small point in this vacuum arc light, R. Tanberg, of the Westinghouse Electric Company, found record heat of 900,000 degrees.

OUR DIET HURTS ESKIMO; HIS IS BAD FOR US

ESKIMOS spoil their teeth eating white man's food, and white men injure their kidney's eating Eskimo food. During the last two generations, the teeth of Eskimo children and young adults around Nome, Alaska, have begun to show cavities and other signs of decay because of their newly-imported diet, claims Henry B. Collins, Jr., of the Smithsonian Institution, Washington, D. C.

For six months a laboratory worker at the University of Michigan lived on a diet of which thirty-two percent was lean meat. Dr. L. H. Newburgh of the university medical department, found that at the end of the six-month period the laboratory worker had symptoms of a kidney disease. As soon as he varied the all-meat diet, the trouble disappeared.

GERMAN VACUUM TUBE HAS NO INSIDE GRID

THERE is no grid inside a new type radio receiving tube recently developed in Germany. As the illustration below shows, this tube, seen on the right, is very much thinner and in every way less bulky than the tubes now generally in use. Around the outside of the thin glass tube, which forms the vacuum, is a metal layer—the grid.

A German inventor has developed vacuum tube which has no grid on the inside and is much smaller than usual.

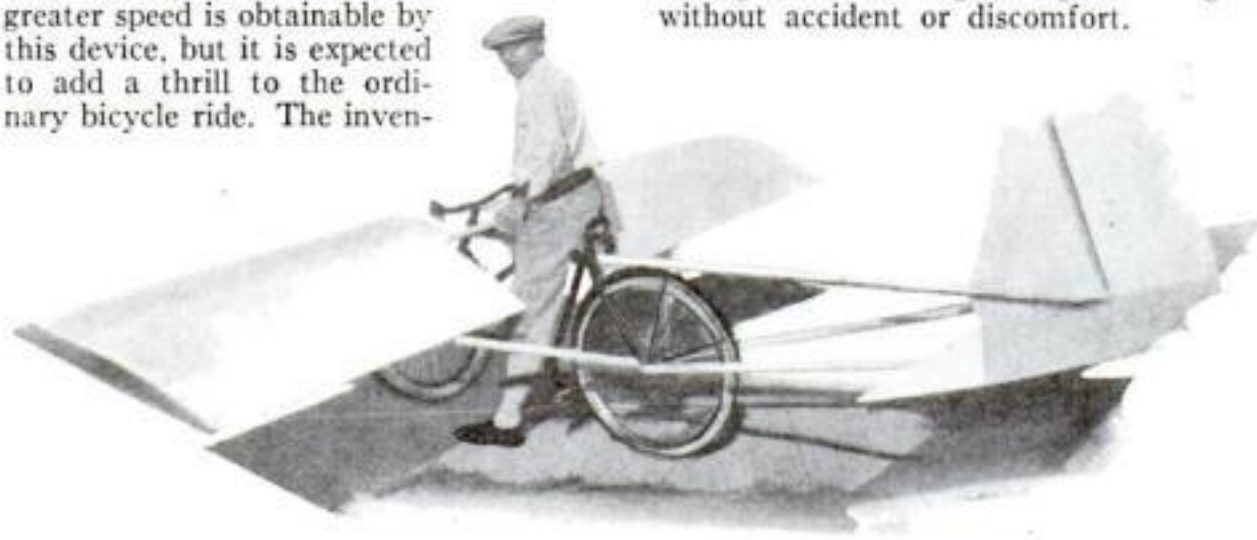
NEW THRILLS FROM WINGED BICYCLE

PART, at least, of the thrill of gliding can be had by bicycle riders whose machines are equipped with wings and tailpiece. This glider outfit is the invention of Harry T. Nelson, Dallas, Texas, World War flyer. It consists of small wings and a tailpiece that, he says, can be readily attached to any bicycle.

As the speed of the rider increases, the wings are elevated and the front wheel leaves the ground. The rear wheel, remaining on the ground, provides the traction. Wing and tailpiece are operated by the handlebars on the front wheel. As long as sufficient speed is maintained, the front wheel of the bicycle remains in the air.

It is not claimed that greater speed is obtainable by this device, but it is expected to add a thrill to the ordinary bicycle ride. The inventor recently demonstrated its stability and safety by riding his winged wheel in a hard gale and coming through the "flight" without accident or discomfort.

With wings and tailpiece attached to bicycle, the front wheel leaves the ground.



Harry T. Nelson, Dallas, Texas, demonstrates the operation of his winged bicycle that glides.

CYLINDER TOOTHBRUSH HAS NO BRISTLES

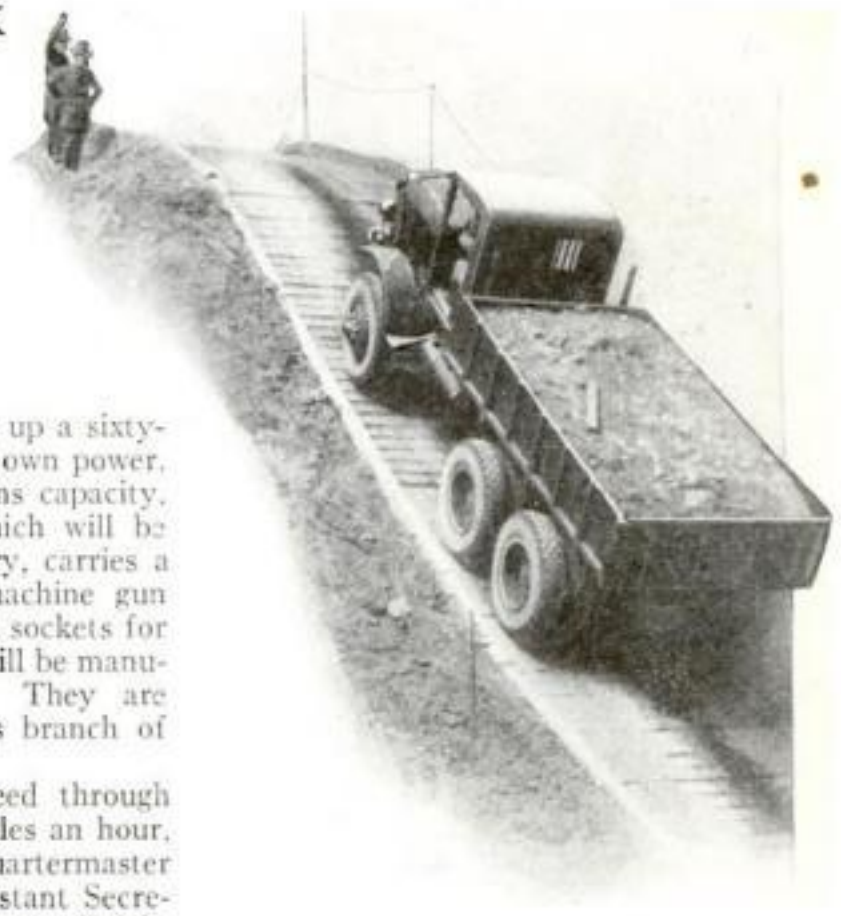
BRISTLES have no place in a new toothbrush which is composed of a rubberlike material arranged in a cylinder with rather deep, narrow grooves. Easily kept sanitary, no danger of swallowing objectional and irritating hairs and adequate gum massage are the features claimed for it.

FAST ARMY TRUCK HILL CLIMBER

CLIMBING straight up a hillside is one of the easiest things a recently tested Army truck does. The trucks, which are meant to be used in the transportation of supplies, are faster than others of their capacity and have so powerful a traction that they are able to run up a sixty-five percent grade under their own power. They are from two to ten tons capacity.

Another type of truck, which will be used in support of the cavalry, carries a crew of four men with a machine gun mounted in a small turret, and sockets for antiaircraft rifles. This type will be manufactured in large numbers. They are expected to revolutionize this branch of the service.

The trucks, which can speed through sand and clay at forty-five miles an hour, were tested at the Holabird Quartermaster Depot, Maryland, before Assistant Secretary of War Payne and high Army officials.



With unusual traction and power, this Army truck easily climbs a sixty-five percent grade.

PUPPET SHOW IS RUN BY CHILDREN

ALL the mysteries of running a puppet show are being revealed to a class chosen from the Los Angeles, Calif., public schools. In giving the thrilling drama of "Jack and the Bean Stalk," the strings were worked by the youngsters under the direction of a skilled supervisor. At the public presentation, Jack climbed and the giant danced in rage at the dictates of little people behind the scenes who excitedly ran the controlling apparatus.

Such a performance robbed one of the most ancient forms of entertainment of much of its glamour, but it gave the pupils a distinct impression of the difference between the artificial and the real. This distinction was not always made in the long history of marionettes. Excavations in Egypt have proved that puppet shows were common in that strange land five thousand years and more ago.

So ancient are puppets that it is impossible to trace their origin. They became popular in Europe following the decline of the miracle plays and reached their height during the seventeenth and the early part of the eighteenth centuries. At first they dealt exclusively with stories from the Bible, and the field widened slowly. That the real and the fake are confused is proved by the riots that not infrequently occurred when harrowing subjects were presented.

In the last decade there has been a decided revival of marionettes and great mechanical ingenuity has been expended in giving the tiny figures lifelike activities.

School children pull the strings. Recently in Los Angeles, Calif., a puppet show of "Jack and the Bean Stalk" was given by young pupils who ran the entire entertainment.

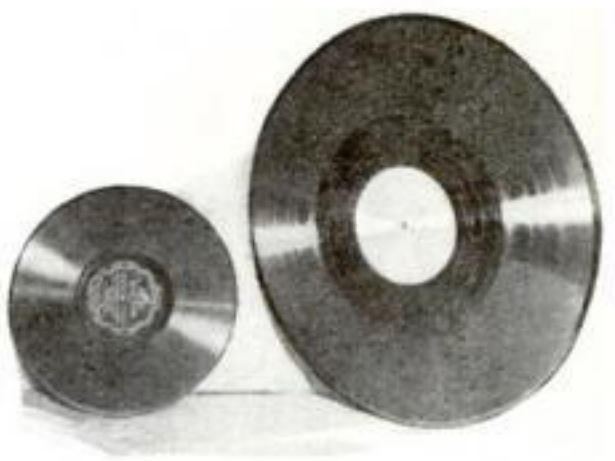
MAN'S BLOOD DRAWN OFF, PURIFIED, REINJECTED

TAKING a patient's blood from his body, purifying it, and putting it back again is an operation that has proved successful in several European countries, according to Dr. Raoul Blondel, French medical authority.

The process was devised by a German surgeon, named Haas, for the treatment of patients with kidney defects and other diseases leading to the appearance of impurities in the blood. Nearly a pint of blood is extracted from the patient and passed through a permeable tube of collodion, immersed in a saline solution, to purify it. Then the purified blood is reinjected into the patient.

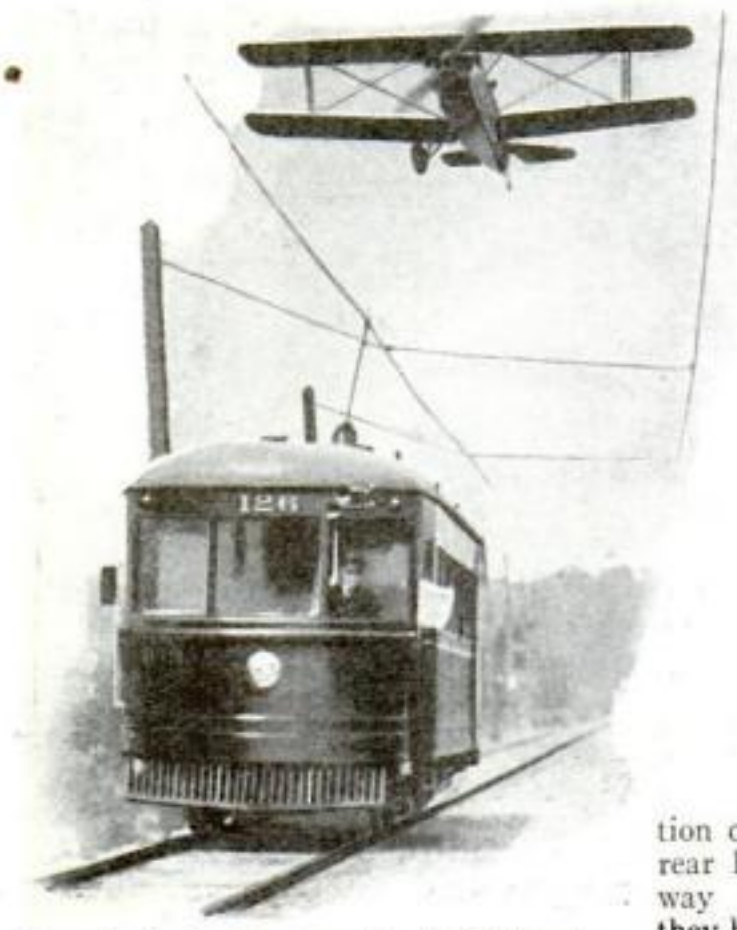
RECORDS NOW USED TO BROADCAST PROGRAMS

PHONOGRAPH records are being used by radio stations to put a fifteen-minute program on the air. The records are unusually large, sixteen to eighteen inches in diameter. Revolved at the slow speed of thirty-three and a third revolutions a minute, one record will last exactly fourteen minutes—allowing time for the announcer to describe the next part of the program.



A big broadcasting record that runs fourteen minutes and one of ordinary phonograph size.

TROLLEY MATCHES SPEED OF PLANE



Recently developed motors give this Ohio trolley a top speed of over ninety miles an hour.

A RED trolley and a blue biplane raced along an interurban right-of-way near Moraine, Ohio, not long ago, and the trolley more than held its own. It was one of the new ninety-mile-an-hour electric cars recently put in service to carry passengers between the Ohio cities of Cincinnati, Columbus, Dayton, Toledo and Springfield.

The latest in trolleys not only boasts a speed seldom attained by any steam locomotive, but in other features it is called entirely new in electric railway transportation. Passengers sit either in individual coach seats or in an observation compartment at the rear like that of a railway train, from which they have a clear view of the scenery whizzing past the windows.

Magnetic brakes of a new type grip the rails and bring the car to a quick stop. Its speed is made possible by recently-developed motors which are sixty-seven percent more powerful than the types ordinarily used in trolleys.

EACH SEAT HAS LAMP IN LONDON THEATER

AN INNOVATION in London's newest theater permits playgoers to read their programs without interruption, even though the space where the audience sits is dark. In alternate joints between the backs of seats, small electric lamps provide a flood of light at the touch of a button. Tubular shades prevent the light from spreading and interfering with other spectators' view of the stage.

The only theater in London so far equipped with these lights is the Cambridge, the most recent to be built and opened in that city. No American theater, at this writing, has installed these individual lamps, nor has any serious test of their popularity yet been made abroad. The cost of installation, which is considerable, may prevent their early general adoption.

Individual seat lights in a London theater make it possible to read while auditorium is dark.

ULTRA-VIOLET LIGHT FINDS CHECK FORGERY

ONE of the first machines to apply the principle of detecting forgeries by ultra-violet light has just been placed on the market in Chicago. It is designed to be installed beneath and behind the counter of the teller's window.

When the teller receives a suspicious check, he simply lays it on a shaded surface beneath the lamp. Erasures stand out in glaring relief, while different kinds of ink glow in as many colors to reveal which was the original. The principle used is that of "fluorescence," by which inks and other substances when activated by the ultra-violet rays give off light of visible colors, according to their composition.

Forgers can't fool this ultra-violet light detective which, by principle of fluorescence, shows erasures and different inks on check.

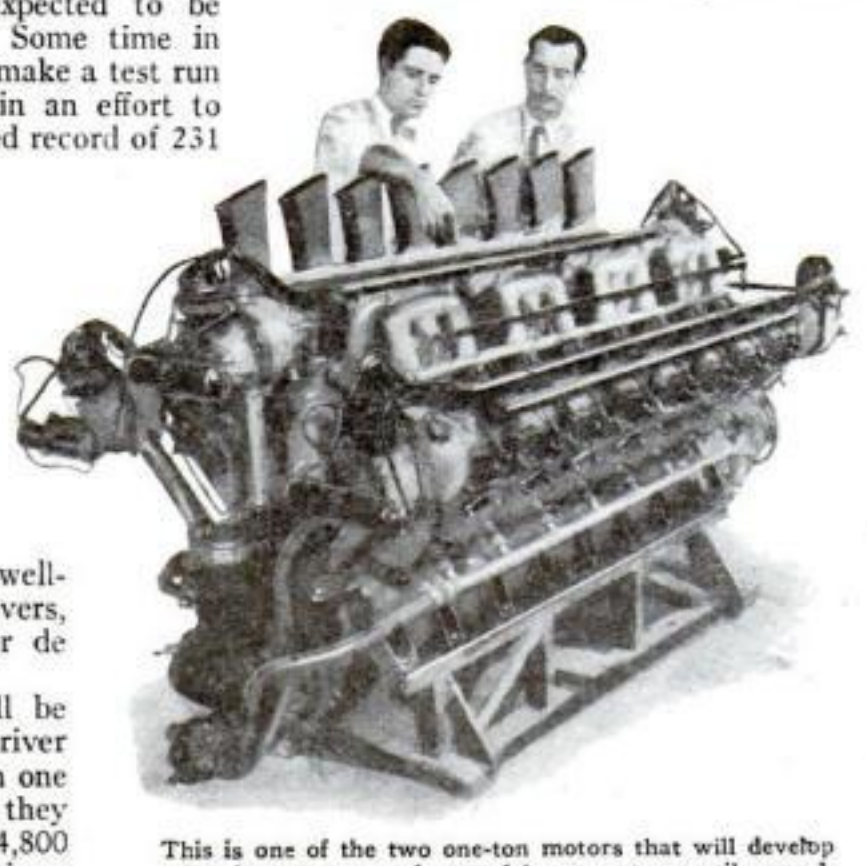
300 MILES AN HOUR AIM OF NEW AUTO

EACH one nearly as tall as a man, two motors like the one pictured here will drive what may be the world's fastest automobile at an estimated speed of 300 miles an hour.

The forty-eight-cylinder racing machine is now nearing completion in Los Angeles, California, and is expected to be completed in December. Some time in January it is scheduled to make a test run at Daytona Beach, Fla., in an effort to break the world's auto speed record of 231 miles an hour set by the famous British racer, the late Major H. O. D. Segrave.

Streamlined like an airplane, the thirty-two-foot five-ton car will have an air rudder at the rear to hold it on a steady course. All four wheels will serve as drivers. The design has been worked out by two well-known American race drivers, Harlan Fengler and Peter de Paolo.

One of the motors will be mounted in front of the driver and one behind him. Each one weighs a ton. Together they are expected to develop 4,800 horsepower, nearly five times the power of Segrave's 231-mile-an-hour *Golden Arrow*. The size of the motor can be appreciated by noting the size of the men standing near it in the photo below, which shows Fengler (right) and C. W. Atwater, business manager of the attempt tc shatter the world's auto speed record.



This is one of the two one-ton motors that will develop 4,800 horsepower and may drive car at 300-mile speed.

COWS EAT SAWDUST AND THRIVE ON STRANGE DIET

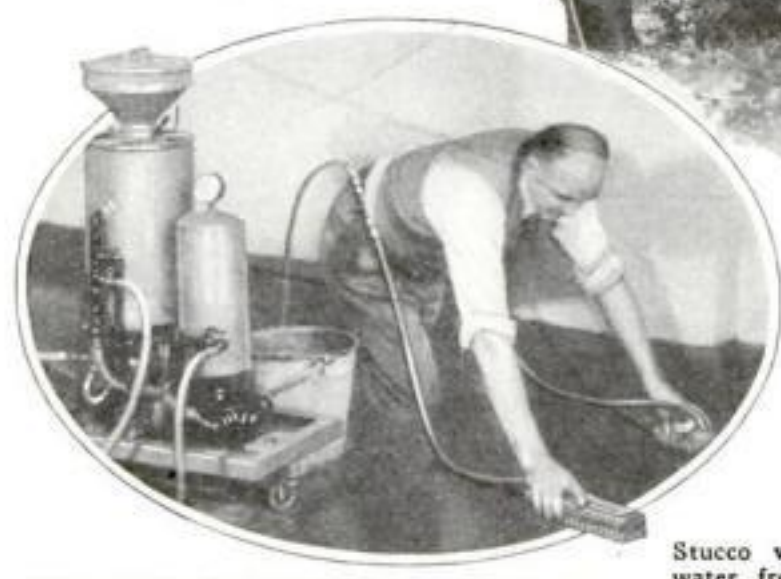
MAKING cows eat sawdust, and like it, is the feat of the Forest Products Laboratory, Madison, Wisconsin. A process has developed that converts the fiber of the woody pulp into food for cattle by treatment with heat and chemicals. Its immediate application is seen in utilizing the sawdust that was formerly a useless by-product of lumber camps. Tests indicate that cows and other livestock thrive on the sawdust diet.

Huge iron retorts, used for the conversion process, are charged with raw material from ports at the end. When the reaction is completed, these ports are opened and the steaming cattle food shoveled out. Although the use of sawdust for food is novel, it is far from fantastic; chemists have pointed out that in theory, at least, it is feasible to convert it into succulent dishes for human beings.

ELECTRIC SCRUBBER CLEANS FAST

FLOORS are cleaned quickly by an electric "scrubber's assistant" recently perfected by a Detroit, Mich., inventor and about to be placed on the market. It may also be used to scrub the walls of house or building, inside and out, with equal dispatch. A simple attachment equips it for use in washing windows. Also, a motorist may clean his car with it in a fraction of the time usually required.

The device is rolled to a convenient place, a water hose connected to it, and its electric cord plugged into a near-by outlet. The cleaning compound is emptied into a hopper. When water and current are turned on, the device mixes the cleaning fluid and pumps it to a mop or nozzle in the operator's hand, from whence it is directed to the surface to be cleaned. A connection on the tank furnishes clear water for rinsing.



The electric "scrubwoman" scours with one hand and rinses the floor clean with the other.

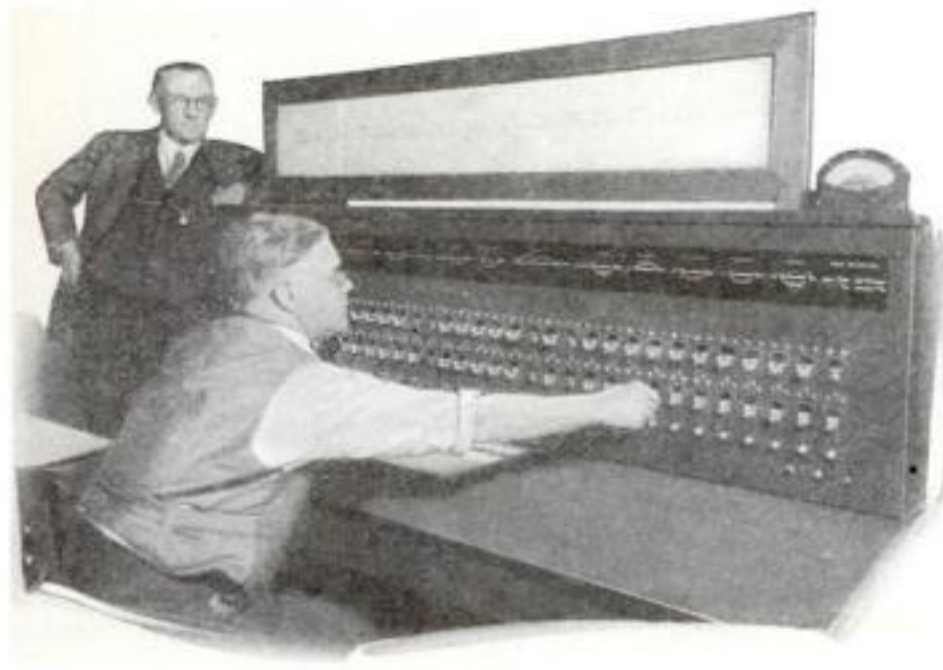
Stucco wall is rinsed with water from pressure nozzle.

ELECTRIC DISPATCHER RUNS TRAINS

ON A forty-mile section of the Southern Pacific Railroad's track in California, one man now controls the movements of trains with the aid of a new electric train dispatcher. Red, green, and yellow lights on a chart before him signal the position of trains along the line. When the central operator wishes to sidetrack a train to allow an express to pass, or to give it a clear signal again, he has only to push the proper signal buttons and turn the small levers that control switches as far as forty miles away. As a further check on the movement of trains, the operator has before him an electrically controlled graph, on which automatic pens trace the trains' progress.

Formerly the passenger and freight trains over this section were handled by telephone and telegraph orders passed along between small stations on the main line. So efficient has the new system proved that it does away with the need for a projected second track to care for increasing traffic, and makes it possible to abolish several way-station telegraph offices with consequent economy.

The new dispatching apparatus also minimizes delays to through trains.

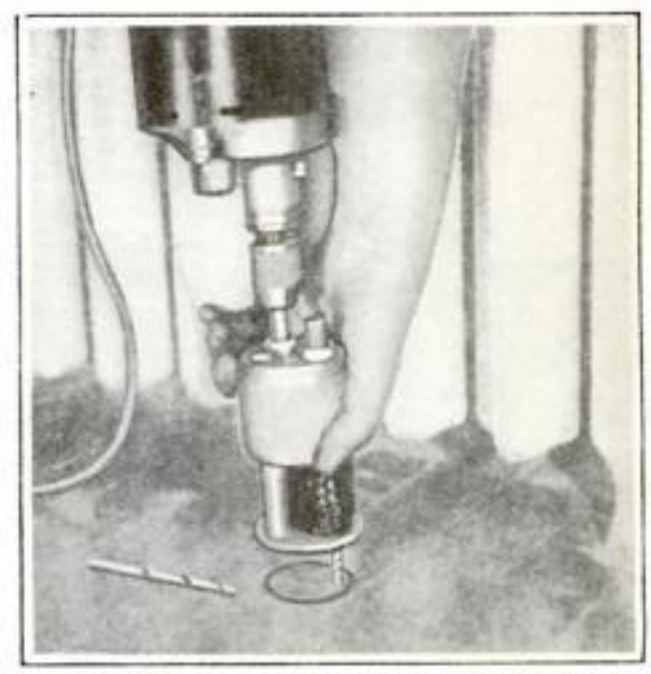


Sitting in front of this board, one man controls the movements of all trains on a forty-mile stretch of Southern Pacific system.

SAW BLADE FOR POWER DRILL CUTS METALS

ROUND holes, square holes, and other shapes of any size whatever are easy to cut for the owner of an electric drill equipped with a novel saw attachment. When the new tool is attached to any power drill, its lancelike saw blade shuttles in and out too fast for the eye to follow, cutting through wood, nails, or metal indiscriminately.

Especially useful to the electrician, plumber, and automobile mechanic, the device is handy in hard-to-get-at places that other tools cannot reach. The attachment is equipped with a chuck for holding machine files of quarter-inch shank.



A lancelike saw blade fitted to a power drill can be used to cut any shape hole through metal.

MOVIE OF BLACK SMOKE WARNS FACTORY MEN

WHEN a St. Louis, Mo., factory owner allows his smokestacks to belch black fumes into the outside air, to the alleged detriment of health and property near by, he receives in the morning mail a little envelope from the Citizens' Smoke Abatement League, of that city. The missive contains a strip of movie film containing photographs of his stacks taken at one-minute intervals, and a request that he take steps to remedy the nuisance in accordance with the law.

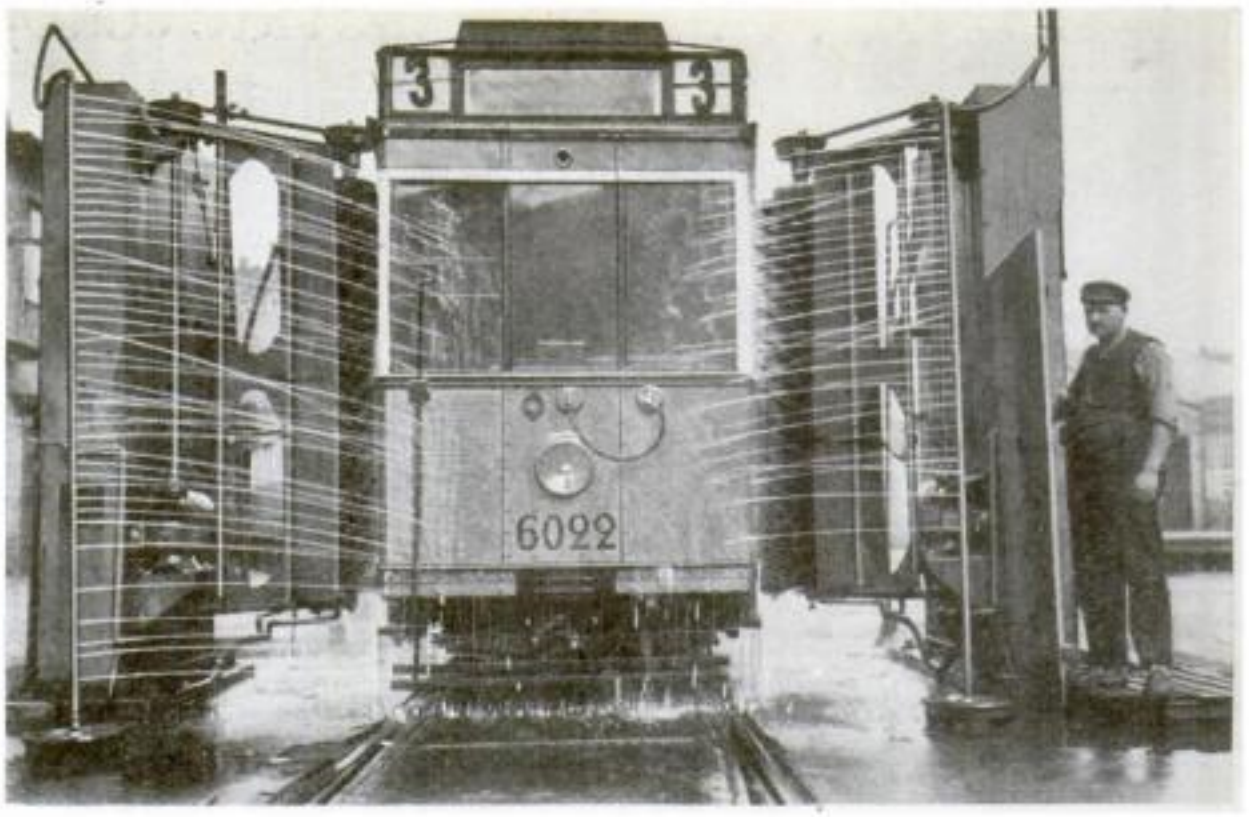
A new type of automatic camera makes possible this ingenious way to settle any argument about the density of smoke and the length of time it lasts. The camera, combined with an electric time clock, operates without attention. Promptly every minute, for four hours, the mechanical detective makes its telltale exposure upon a strip of movie film.

This robot camera makes movie pictures of factory smoke when it becomes too black.

WHITE WINGS NOW RIDE ONE-MAN CLEANING CAR

CHUG-CHUGGING through the streets of Rome, Italy, go the street cleaners, since the introduction of one-man motor outfits for the "white wings." The new vehicles resemble motorcycles but have three wheels. A box for litter occupies the place used, in more familiar vehicles of this type, for carrying parcels in other cities. So rapidly can the street worker cover a section of asphalt pavement with the new machine that fewer men are now needed to keep the streets neat.

One of the three-wheeled motor carts that are being used by white wings to keep Rome clean.



MOTORCYCLE CAUGHT IN RECORD SPEED TEST

How a two-mile-a-minute motorcyclist would look, speeding toward the finish line, is strikingly shown above in the novel photograph of J. F. Wright, British speed king.

Shortly after the cameraman snapped the picture, the noted racer raised the world's motorcycle speed record for the one-kilometer distance (about five-eighths of a mile) to 137 miles an hour, breaking the mark formerly set by a German rider, who hit the fast time of 134.6 miles per hour.

Wright also bettered the record for a mile distance with an average speed of nearly 136 miles an hour. The new records were made at a race course near Paris, France. The photograph reproduced above was made before Wright started his record-making dash at the one kilometer distance.

STREET CAR WASHED BY AUTOMATIC SPRAYER

Now Berlin street cars get a daily shower bath early in the morning, before they go out on service. Automatic sprayers beside the track, of a type already successful in cleaning locomotives and railroad cars (P.S.M., Oct. '30, p. 36; Nov. '29, p. 60,) spurt high-pressure jets of water against the sides of the trolleys and wash away dirt and grime. Meanwhile revolving brushes administer a thorough scrubbing and polishing.

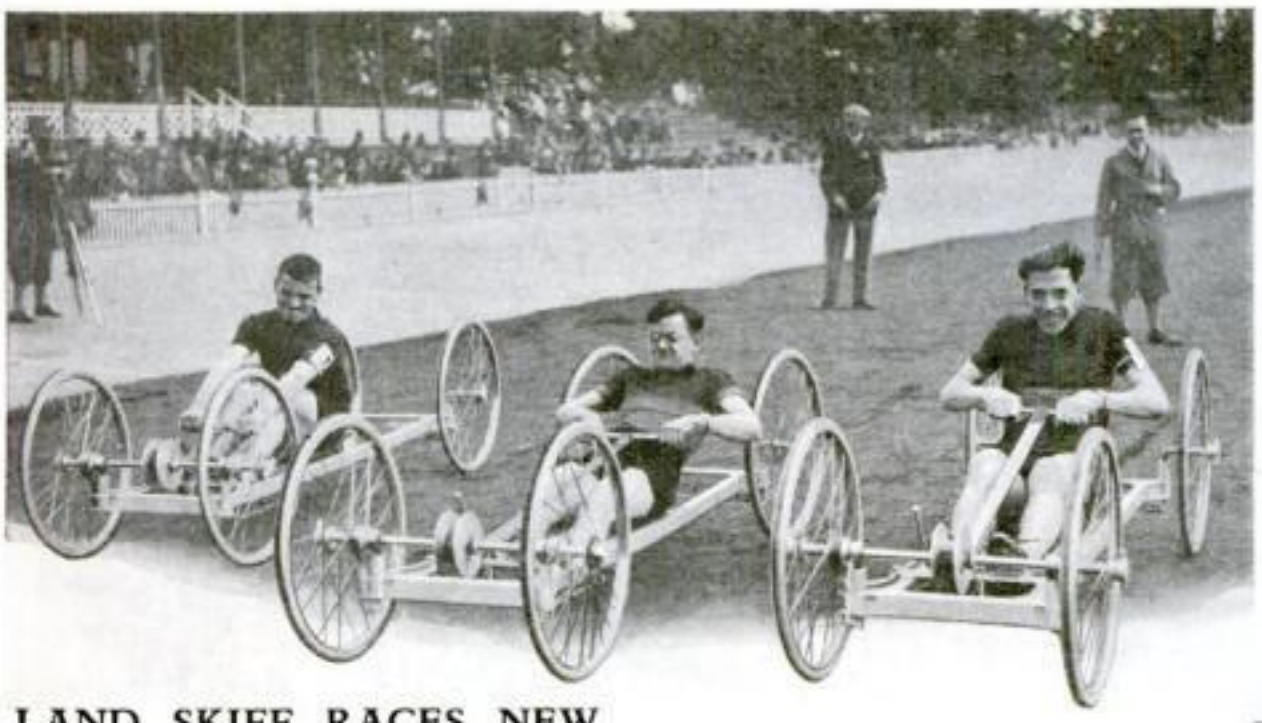
ELECTRIC HEATER KEEPS ICE OFF WINDSHIELD

FROSTY panes of automobile windshields may have their terrors melted away by a novel contrivance acting as a special windshield heater for wintry weather, which is illustrated in the photograph below.

This electrical "defroster" warms the glass and prevents ice and snow from getting a hold on it. The device may be attached to the windshield of any car. It is put on in a few seconds without bolts or screws. Two suction caps hold it securely to the glass.

It is attached to the inside of the glass and connects with the battery. As a result, even when the car is standing still, the heat is on and no ice or sleet can form on the outside of the windshield.

Two suction caps hold this electric "defroster" to inside of windshield to keep it free of ice.



LAND SKIFF RACES NEW SPORT IN ENGLAND

ROWING on land has become a popular sport in England with the introduction of the "land skiff," new racing vehicle. A sort of hand-propelled scooter, the land skiff is driven by the forward and backward strokes of a handle. A belt coiled on a ratchet around the front axle spins the wheels and sends the vehicle over the ground at a rate limited only by the muscular strength of the contestant. Every part of the machine is built for lightness, and the featherweight chassis is swung on four bicycle-type wheels. The driving mechanism is so simple that it does not materially add to the weight.

Thrills aplenty occur at the turns, where collisions and spills are not uncommon. From the crowds that attend such a race as that pictured, at Herne Hill, England, the sport is rapidly gaining approval, indicating that it may prove a rival to the bicycle races which still draw enormous crowds in certain cities.

TEACH WOMEN TO DETECT BAD FOOD

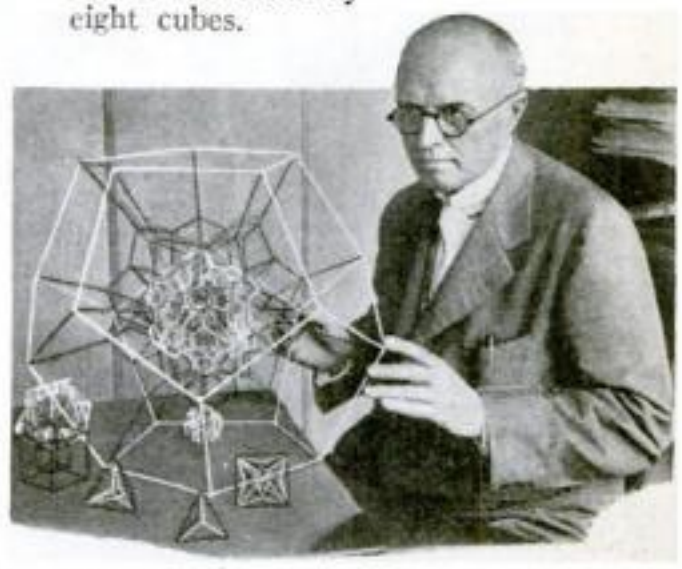
WATERED milk and adulterated food will not fool the future American housewife, if present plans of the American Chemical Society materialize. That body expects to teach every housewife how to detect impure foods.

First step in the plan is a survey, now under way by committees in all parts of the United States, to find out just how much chemistry the average woman knows. Then the society will develop a chemistry course of study, free of technicalities. Women will receive tutoring in the subject through study groups in women's clubs.

MODELS TO GIVE VIEW OF FOURTH DIMENSION

Now the mysterious "fourth dimension," pet concept of mathematicians, may be made clear to the layman. Or, again, it may not. It all depends upon the success of Dr. Paul R. Heyl, of the U. S. Bureau of Standards, who is building models to show what a four-dimensional object would look like. It would have length, breadth, thickness—and something else.

Mathematicians can predict what such a figure would look like by comparison with a line, a plane, and a cube—figures of one, two, and three dimensions respectively. The four-dimensional figure would be bounded by eight cubes.



When finished, this model by Dr. P. R. Heyl, of Bureau of Standards, may have fourth dimension.

CANDLE KEEPS ICE FROM FORMING ON WINDSHIELD

TO KEEP ice, snow, and sleet from forming on the windshields of storm-swept cars an ingenious candle device has been invented. Many a driver knows the trick of sticking a lighted candle near the windshield, an idea embodied here in convenient form. All that is needed to attach the device to the windshield is to moisten the small vacuum cup fastener and press it firmly against the inside of the windshield, setting the candle in an upright position under the windshield wiper. The flame should be about a quarter of an inch away from the glass, and the candle may be adjusted to this distance by merely bending the metal holder. A shield keeps light out of the driver's eyes.

A suction cup, pressed against the windshield, holds a candle that keeps the glass clear of sleet.

GERMAN BABIES NOW GET SUN BATH

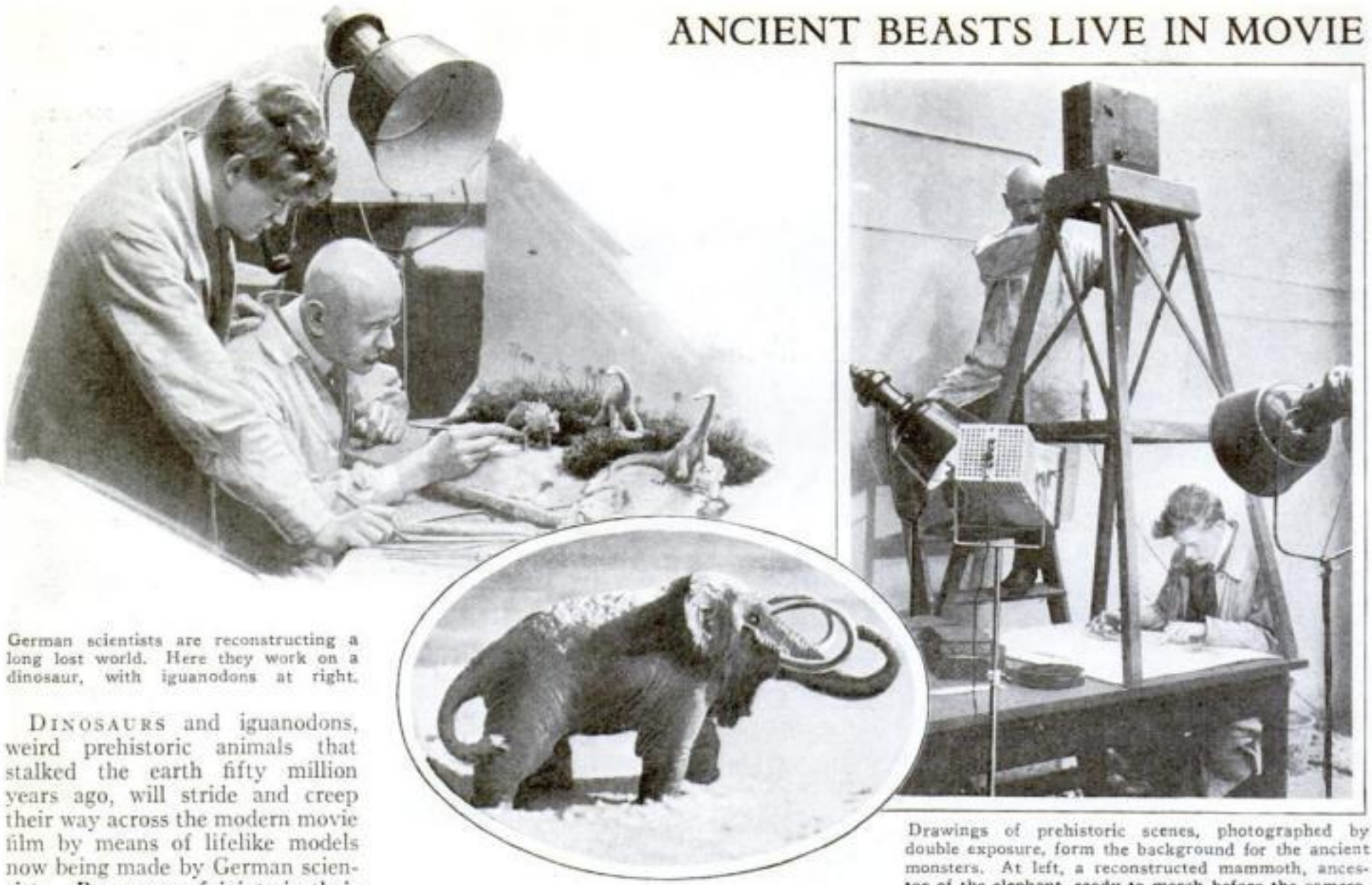
IF SUNLIGHT is good for adults, it's all the better for growing children. So reason physicians at one German hospital, where the youngest infants now receive their daily sun baths whenever weather permits.

Rows upon rows of babies, dressed in light clothes that permit the fullest benefit from sunshine, are laid upon the lawn of the Berlin hospital for their solar exposure. Nurses in attendance keep a watchful eye upon their charges and whisk them away should rain or chilling clouds interrupt the treatment.

Especially popular in Europe, sun-bathing has graduated from the status of a fad and has become a recognized health aid. Vacation "tan" is prized, not for appearance's sake alone, but for its constitutional effect, since physiologists now recognize the aid of the sun as a germ-killing agent. Its rays are also acknowledged, today, to aid in the mysterious chemical processes by which the human body is provided with vitamins.

On the theory that what's good for grown-ups is good for babies, these youngsters get their daily sun bath.

ANCIENT BEASTS LIVE IN MOVIE



German scientists are reconstructing a long lost world. Here they work on a dinosaur, with iguanodons at right.

Drawings of prehistoric scenes, photographed by double exposure, form the background for the ancient monsters. At left, a reconstructed mammoth, ancestor of the elephant, ready to march before the camera.

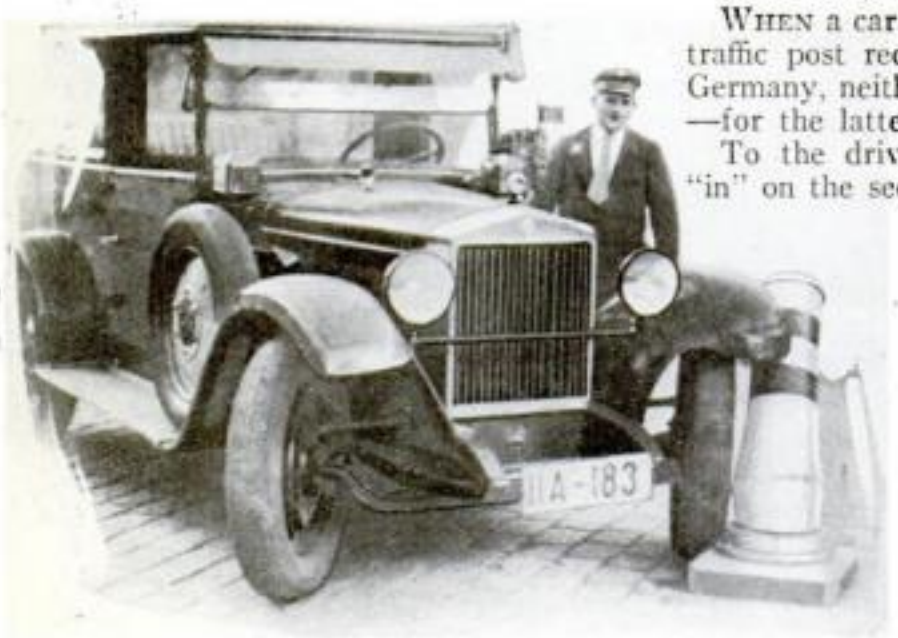
DINOSAURS and iguanodons, weird prehistoric animals that stalked the earth fifty million years ago, will stride and creep their way across the modern movie film by means of lifelike models now being made by German scientists. By means of joints in their structure, the models are made to move slowly about the miniature stage, one step or gesture at a time. Each position is filmed separately. When the completed film is projected, the models appear to be walking in a prehistoric jungle.

The process of constructing the tiny models is a difficult one, involving much skill as a sculptor and accuracy as to details. Careful photography is then necessary to film the models in scale against artificial backgrounds.

The re-creation of these animals was possible only after long and careful study of fossil remains. From these stonelike bones, found in various parts of the world, the strange monsters were reconstructed. Their way of life was determined, to a large extent, by their teeth. The kind of world and climate in which they lived was deduced, in part, from the nature of the material in which their bones were found embedded.

Naturally, the fossil skeleton would give the size of the prehistoric animal, which may have lived millions of years ago. The feet and teeth would tell how it captured its prey and what it ate. The lizardlike beasts were then modeled to conform, along general lines, to the structure of living representatives of the same species. Fortunately in some cases, as the mammoth, whole animals were found preserved in ice and thus it was possible to determine even the nature of the hair covering. Now it is generally believed that much is really known of the ways and looks of the giants of the Age of Reptiles.

NEW TRAFFIC POST MADE OF RUBBER



Carelessly smashing a car against a traffic post in the streets of Munich, Germany, does no harm as the posts are now solid rubber.

WHEN a car collides with a new kind of traffic post recently installed in Munich, Germany, neither car nor post is damaged —for the latter is made of solid rubber.

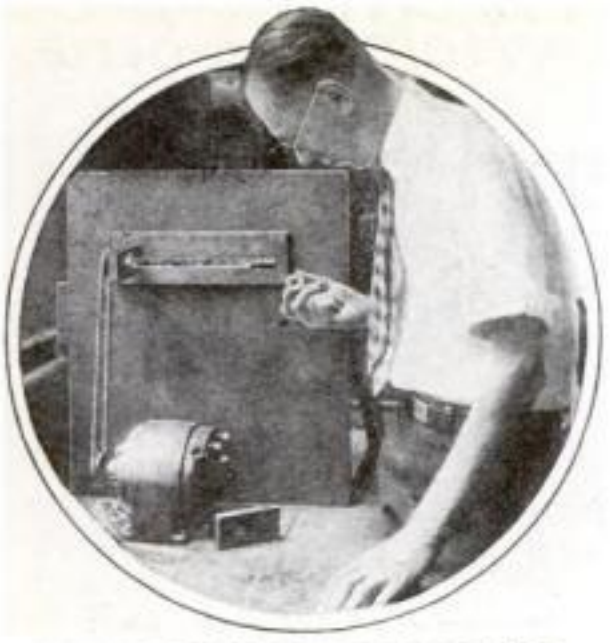
To the driver's surprise, if he is not "in" on the secret, the post bends out of the way. Frequent grazing of markers by careless drivers prompted the novel experiment. Tests showed that the posts would bounce back into place as if nothing had happened, ready for another erring motorist.

Too low to be of danger to a swerving automobile, a heavy base keeps the rubber pedestal from being knocked over or carried from its position by an automobile.

YOU CAN NOW PRESS PANTS WHILE IN THEM

A NEW electric presser is said to be the only device that can give trousers a crease while they are being worn. A user holds the top of the trouser crease and runs the iron down the leg. V-shaped jaws open at the touch of a thumb lever to grip the fabric and apply necessary heat from electric current.

Crease 'em while you wear 'em is now possible with the aid of this electric trousers presser whose heated jaws take out wrinkles.



NEW OILLESS BEARING LUBRICATES ITSELF

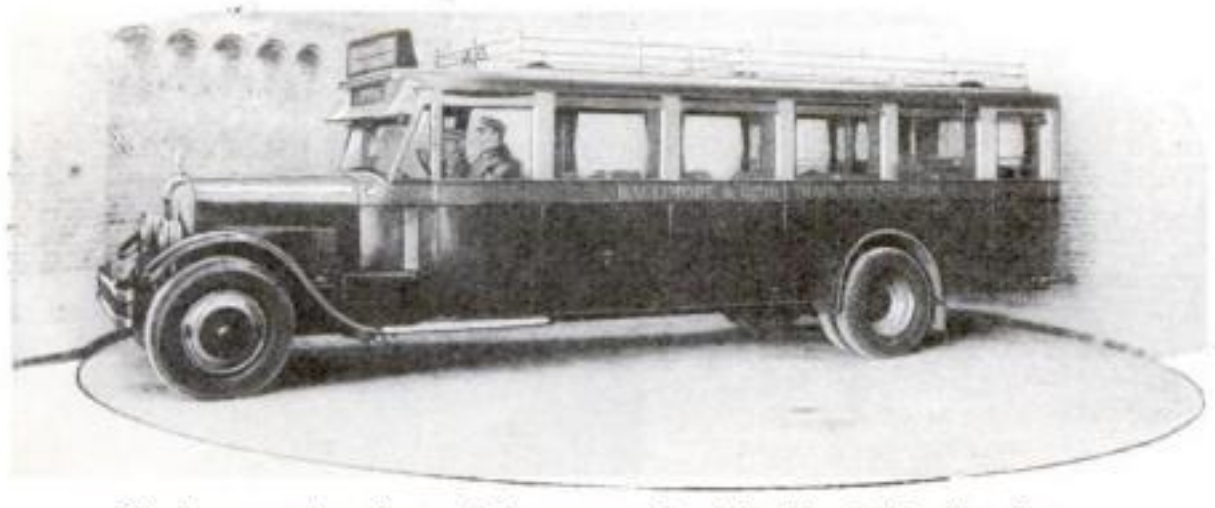
A NEW type of "oilless" bearing for anything from automobiles to steamships, and typewriters to telescopes, has just been announced. It needs no oil, for it lubricates itself. For heavy duty it may be used with oil, but if the oil should run out by accident, the self-lubricating bearing will operate for a considerable time without damage from heating.

Searching for an ideal lubricant, the Westinghouse Research Laboratories chanced upon a soapy substance that seemed nearly perfect for reducing friction, but tests showed it could not possibly be incorporated in an oil. So W. C. Wilharm, research engineer, discovered a way of combining it with the actual bearing metal itself. This is done in a mold, by squeezing the heated materials at a temperature of 400 degrees Fahrenheit under the tremendous pressure of 200,000 pounds to the square inch.

THIRTY-FOOT TURNTABLE SWINGS BUSES AROUND

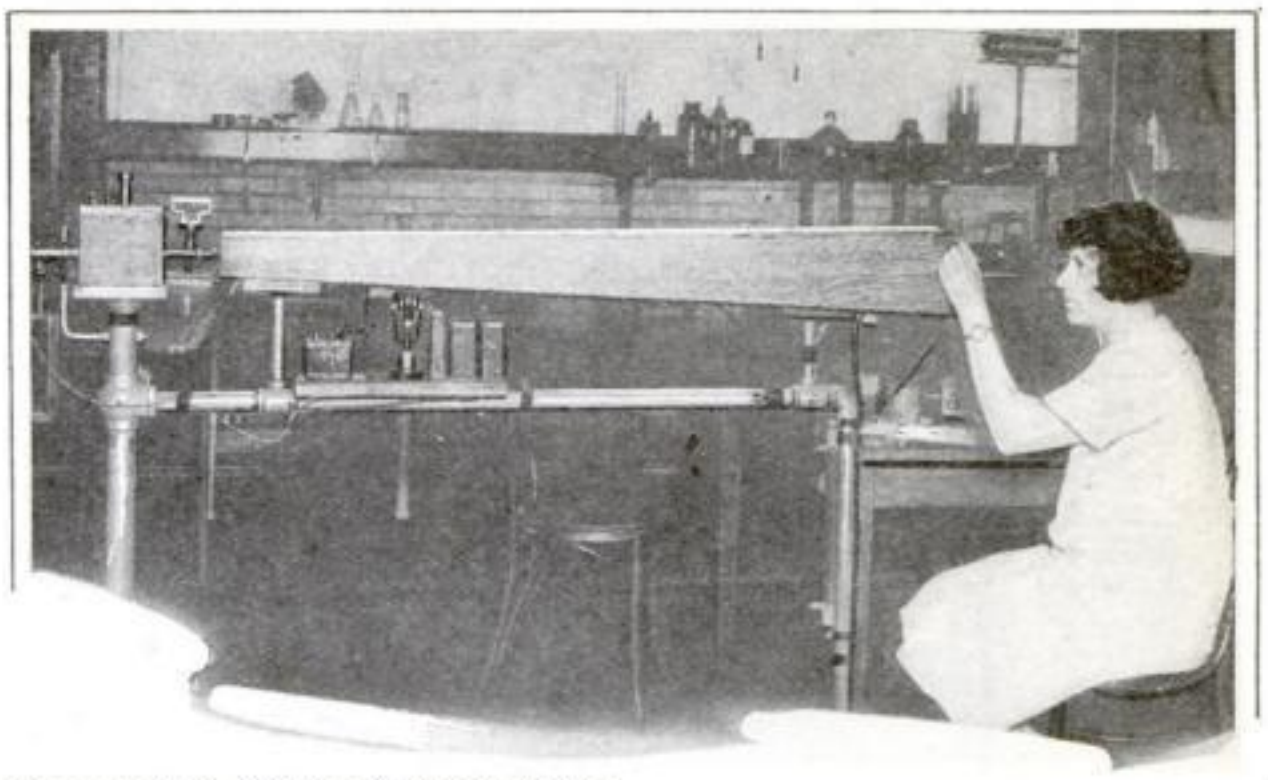
AN EASTERN railroad which maintains a connecting bus service solved the problem of getting buses in and out of the station by building a turntable. This table, sunk in the pavement, is thirty feet in diameter and turns on cork bearings.

When a bus enters the two-lane driveway, it stops on the right-hand side of the turntable, which then swings the bus around until it heads the other way and can leave by the other driveway. The turning operation does not delay the bus, as it requires less than one minute.



Big buses entering the terminal run onto the right side of this thirty-foot turntable. Electric motors swing it around and the bus then faces the exit.

STUDY RADIUM RAYS NINE FEET AWAY



Workers in U. S. Bureau of Standards study radium with electroscope and so avoid handling it.

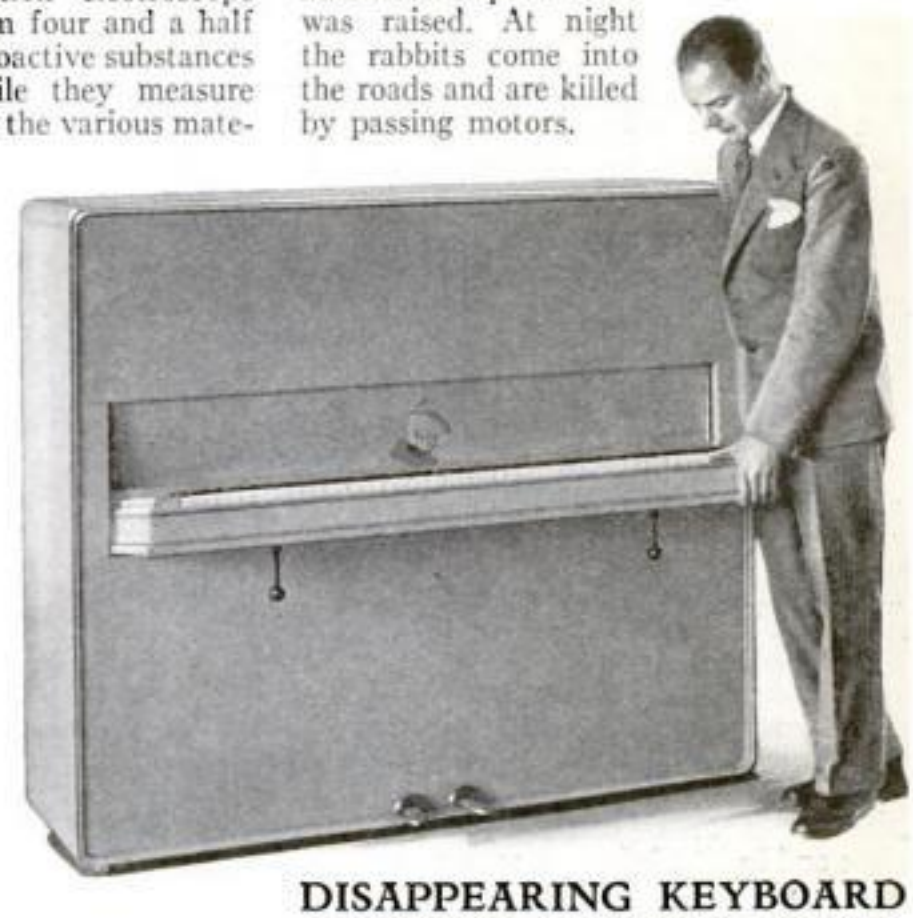
LIKE an observer watching a battle through a telescope, out of range of the bullets, are United States Bureau of Standards workers who are making tests with dangerous radium at the laboratories in Washington, D. C.

An ingenious projection electroscope permits them to sit from four and a half to nine feet from the radioactive substances under examination, while they measure the amount of radium in the various materials by the rate of discharge of the electroscope.

The danger of handling radium is now thoroughly recognized and the projection electroscope is one of several precautions being taken to keep workers from too close contact with this mysterious substance discovered by Pierre and Marie Curie in 1898. The electroscope was developed by the Bureau and it has been found effectively to protect the workers from radium burns, sometimes fatal.

CARS KILL OFF RABBITS

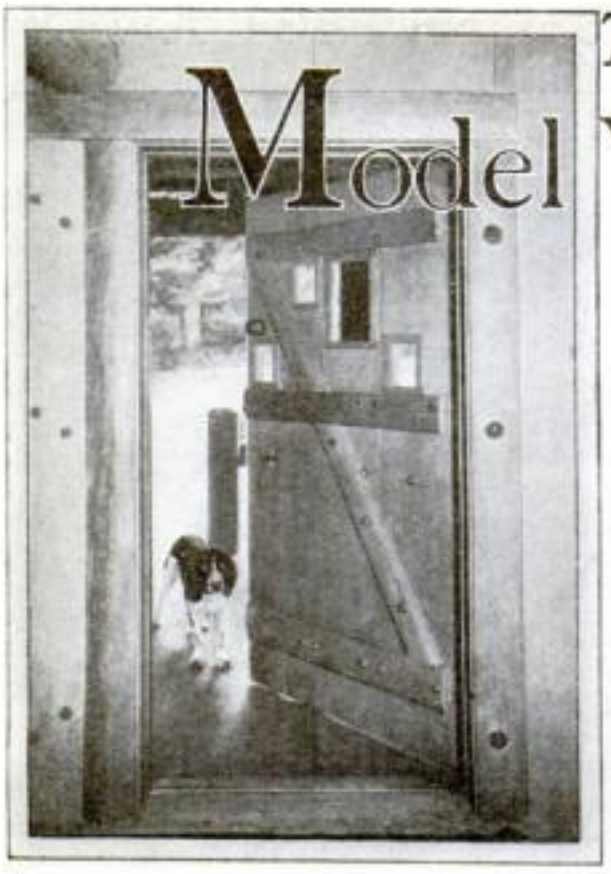
NEW JERSEY'S State Fish and Game Commission recently ordered 5,000 western rabbits for restocking the land. The reason was that mortality among the native rabbits has increased amazingly since the automobile speed limit was raised. At night the rabbits come into the roads and are killed by passing motors.



DISAPPEARING KEYBOARD CHANGES PIANO'S LOOKS

AFTER enough tunes have been played on a new style of piano, the keyboard may be folded up. It disappears into the front of the novel instrument, making it impossible for dust to accumulate.

Unusual in its striking shape, the piano is designed to harmonize with furniture of the "modernistic" style. The disappearing keyboard enhances the effect. All the piano's mechanical features, including the action mechanism and the sounding board, were rearranged within the case in a new system to accommodate them to the unusual form of the exterior. The instrument was built by a Swedish firm. Rearrangement of strings and hammers, which was found necessary, has not, it is said, interfered with its tone quality.



The Architect Builds His Home—A Series

Model Your Home and See It Before You Start Work

Comfort and beauty combined in this building designed by one architect of Seattle for another—Balcony above dining room is one unusual feature

By JOSHUA H. VOGEL

WHEN I finally succeeded in taking time off from designing other people's homes to plan one for myself, I faced an unusual problem. I was about to design a house to be presided over by another architect, Helen Hollister Vogel—my wife!

We both graduated in architecture from Ohio State University in 1912. Then, after our marriage, we spent years in the Orient where I designed churches, hospitals, and other public buildings in Japan, China, and Korea.

With such a wide and varied experience in many lands where all sorts of unconventional problems had to be solved, it was natural that we should attack the problem of designing our own home without being trammeled by conventional ideas.

The lot we chose measures 104 by 106 feet, lying between two sixty-foot roads in Beaux Arts Village, Washington, just across Lake Washington from Seattle. It is close to a five-acre natural woodland park, so that the whole setting is rural and somewhat primitive.

We wanted a dwelling that would be undisputably American and that would fit into and form part of its natural setting. After much discussion we decided on a primitive Colonial type with the large log units left exposed. Being modern in our tastes and habits, however, we wanted the interior to combine informal appearance with modern comforts.

WE FOUND a wide variety of trees on the chosen site. There are cedars, yew, dogwood, hemlock, madronas, and firs. There are evergreen, laurel, and privet box hedges, a wealth of Oregon grape, and ferns so that greenery prevails throughout the year.

One of the first tasks was the cutting out of alders and such small trees as were not headed for a well-rounded maturity. Larger trees were undisturbed and the ground was cleared out in such a way as to leave a growth of wild ferns and wild roses, which bloom on both sides of the house. Of course lawns were laid and a rockery installed close to the house.

The public roads bounding the lot on two sides are at different levels, so that it was easy to arrange a semicircular driveway from one road to the entrance and from the second road to the garage in the basement of the home.

Twelve hundred feet distant lies Lake Washington, whose shores provide bathing and recreation for us and for the six young ones who may someday follow their parents' footsteps into architecture.

With such a sizeable family, we needed plenty of space, so it was decided to make the house three stories high with ten rooms.

The foundation is concrete with the exterior walls for the basement floor made of concrete and brick veneer. The house is of the usual studded construction with split cedar slabs forming the exterior of the first floor and rustic cedar siding on the second and third floor exteriors. The roof covering is split cedar shakes.

My own investigations of old homes in Virginia and elsewhere built of wood in somewhat this fashion convinced me of the long-life qualities of such timber construction.

Exterior trim, frames, and sash are of fir. The outside dimensions are thirty by forty-eight feet.

So much for the exterior. The main floor arrangement comprises living room, dining room, all-electric kitchen, and a guest chamber with bath. This guest chamber serves a combination purpose—both we and the children use it for a study room when it is not needed for guest purposes.

On the second floor are three large bedrooms, one small bedroom, a bathroom, closets, and chil-

Balcony overlooking the dining room is turned into playroom for the children.

Stairways of natural logs, with the underside exposed, emphasize the true Colonial feature of the home.

dren's playroom balcony overlooking the dining room.

This balcony at one side of the dining room was an afterthought as we stood within the framework of the new dwelling in the days of first construction. We wanted the dining room to have its natural high sloping ceiling from its widest outer side, but this left an unusually large and almost unbroken wall space on the principal interior side.

Accordingly the balcony, with its entrance from the second floor, was decided upon. It is, of course, suitable for a wide variety of decorative or practical purposes, but we find that it makes an ideal playroom for our four small daughters.

HERE, I might point out, is an instance of the woman's touch in home designing. By simply opening the kitchen door, which enters upon the dining room, Mrs. Vogel can check up on what the children are doing without interrupting her household duties.

On the third floor are two more bedrooms and storage closets.

Thus, of the ten rooms in the home, six are normally bedrooms and a seventh is quickly obtained by converting the combination study and guest chamber.

Aside from its desirability for the use of guests, the main floor bathroom is a decided family convenience. The use of the shower in this bathroom is restricted to us grown-ups and the four girls. The two oldest children, both boys, have their own shower in the basement for use when they come in from the lake.

The interior walls of the living room and guest room on the main floor are ply fir panels with fir bats. The ceiling is of cedar logs, which serve as floor joists for the story above. Between these cedar logs are fir panels. The finish of these walls is aluminum stain, a sort of silver gray which is high in light-reflecting qualities.

The living room flooring is maple except in a bay window addition overlooking the lake where West Coast upland hemlock and maple are interlaced.

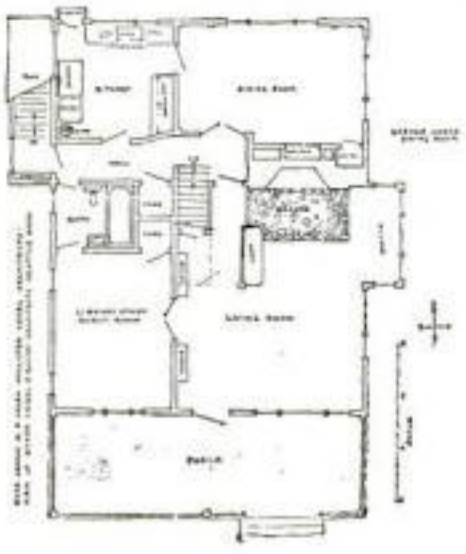
The house is half lost in its sylvan setting, as cedars, yew, hemlock, and firs rise above it.

This front view of the Vogel home gives an excellent idea of the charm of its setting and the rustic simplicity of design.

This West Coast hemlock, I find, is a harder wood than eastern hemlock and if no oil or stain is used its finish is virtually the same color as maple. The use of West Coast upland hemlock for gymnasium floors has proved its hard-wearing qualities.

The living room floor finish is starch filler with wax surface. Floorings in the rest of the house are of fir.

The main door of the house, we find, wins the interested attention of all visitors. It is constructed of slabs, the curved surfaces being on the exterior and flat surfaces inside. Heavy bolts and wrought-iron hinges add to its charm.



At left, plan will give clear idea of convenient arrangement of rooms on the first floor of Vogel home. Note study and guest room combined, with bathroom which is one unusual feature.

At right, plan of the second floor, showing bedrooms opening from central hall and the balcony playroom which is visible from kitchen.

THE massive stone fireplace and hearth is the chief living room attraction. Half a cedar log, supported by log brackets, constitutes the mantelpiece. This log shelf, and the other interior exposed logs, are finely sandpapered and finished as already described.

As an all wood interior would be monotonous, we covered the rest of the walls, except those of the living room, with gypsum board, felt, and paper.

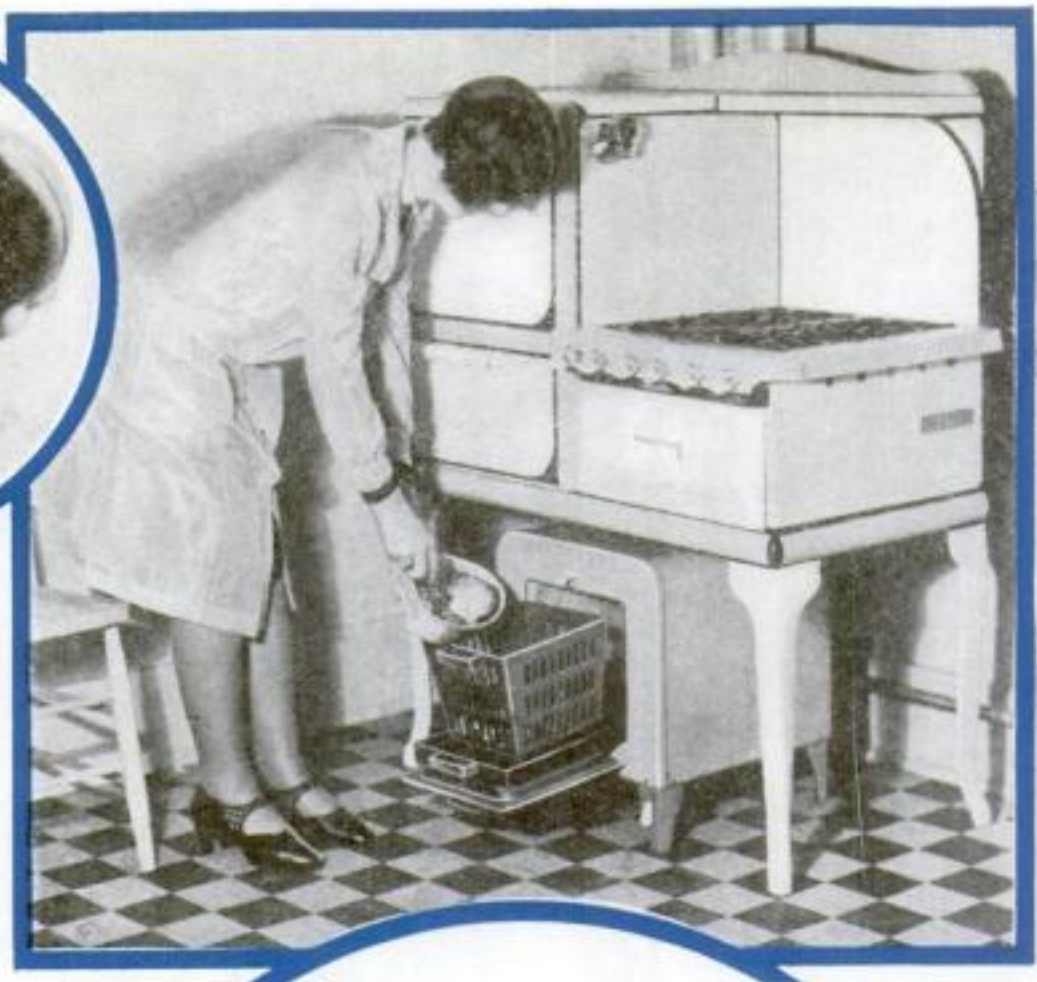
In the dining room, although the cedar roof rafters and main log framework have been left exposed, all trim, built in china cabinets and the like, is finished in old ivory. This was Mrs. Vogel's idea. The result is attractive and has the added advantage of being kept clean with but little effort.

Dining room lighting fixtures are Colonial in design to accord with the old ivory finish. In the living room they are of wrought iron.

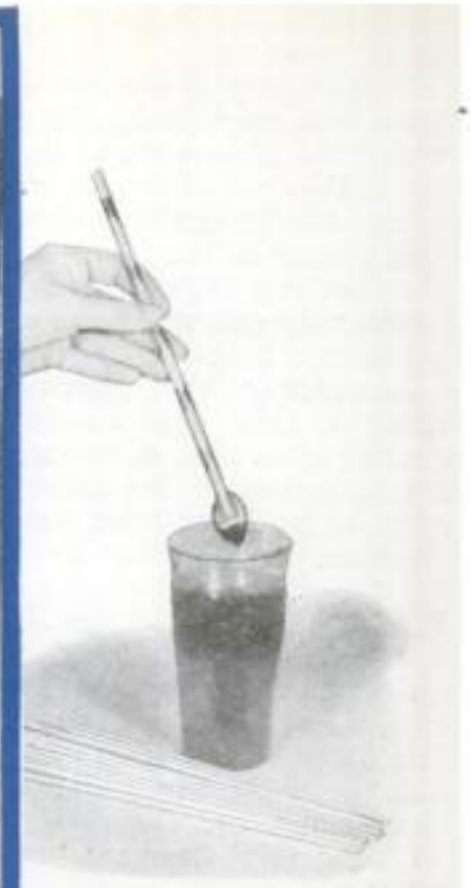
On going upstairs, by means of natural log stairways with the underside exposed, you will find papered bedroom walls and Colonial lighting fixtures, although the rounded cedar rafters of natural saplings are left showing in a number of instances. Mrs. Vogel *(Continued on page 143)*

Thirteen New Aids Designed for the Busy Housewife

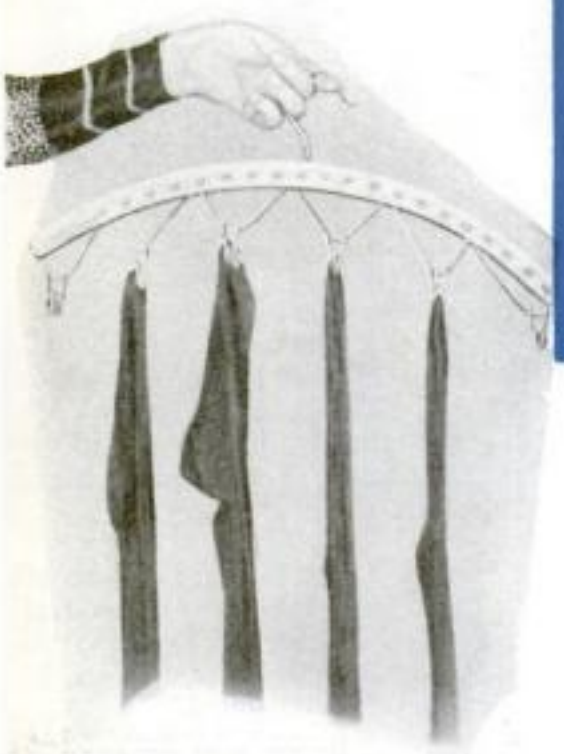
SOAP IN STEEL WOOL. In order to protect the user's hands and expedite cleaning, a holder for steel wool has been developed which makes it unnecessary to handle the wool, which is impregnated with soap.



BURN YOUR RUBBISH. Food wastage and scraps from cooking are quickly disposed of in a kitchen incinerator, right, that can be installed under any gas range. It connects with stovepipe so all odors escape, has a pilot light for burners, and a convenient control handle.



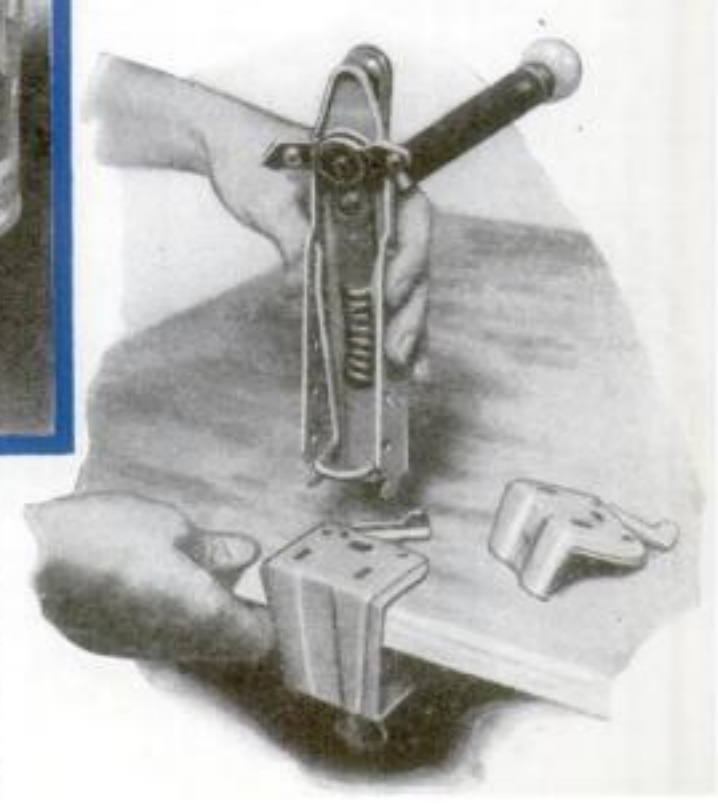
PROTECTS THE STRAWS. A metal holder developed in Germany is designed to prevent the sipping straw from breaking, but without interfering with its use. The device can also be used as a long handled spoon for stirring cold drinks, as the hollow handle is made of durable material.



HANGER FOR STOCKINGS. Dresser drawers are not cumbered with stockings if a converted coat hanger is used to hold them straight and convenient in your closet. It has metal clips that will also hold drying gloves.

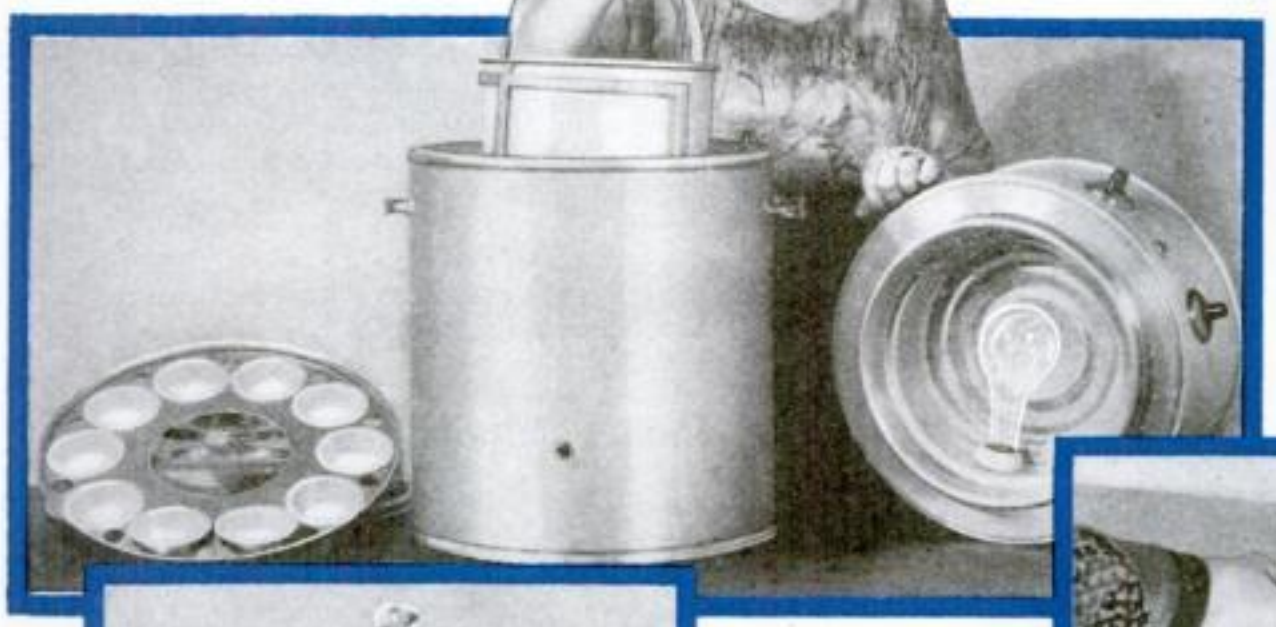
GUARD YOUR FINGERS. During the canning season, when much fruit is pared, fingers held against the back of a knife become sore. To prevent this, a guard has been made that fits the knife back and is broad enough to protect fingers.

CUTS TOP FROM CAN. Little effort is needed to open a can with a device that is practically automatic. The opener holds the can and as a handle is turned, a sharp edged wheel neatly cuts out the top. At right are shown the two bases, one to clamp to shelf and the other for permanent attachment with screws. The opener holds the can until it is released.



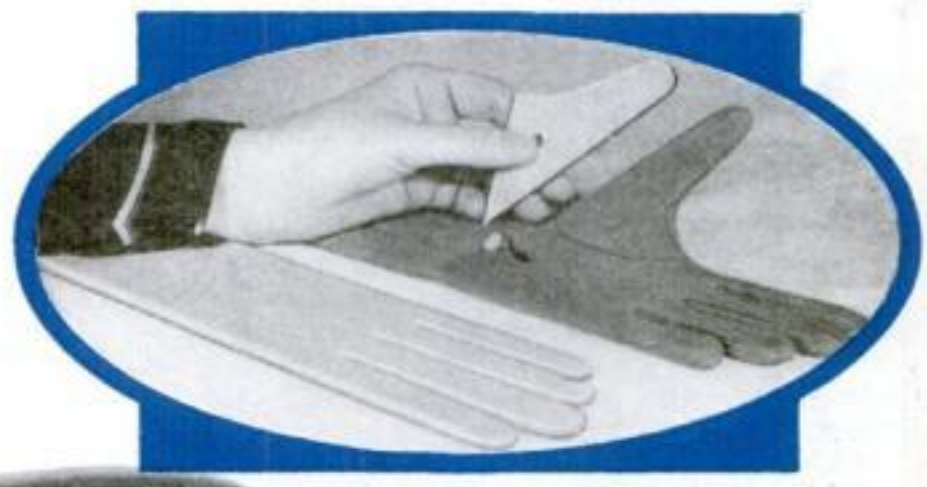
SAVE THE PIE JUICE. When baking fruit pies there is always a chance that the juice will bubble over and burn in the oven. This is avoided by means of a grooved ring that goes under the edge of the pie tin and fastens snugly, thus making a deep dish that holds the juice.

COOKS WITH ELECTRIC LAMPS. Two standard 150-watt lamp bulbs, in top and bottom of a new electric stove, give heat enough to cook a whole meal in three hours. Insulated walls retain the warmth. A pan attachment in the top bakes muffins.

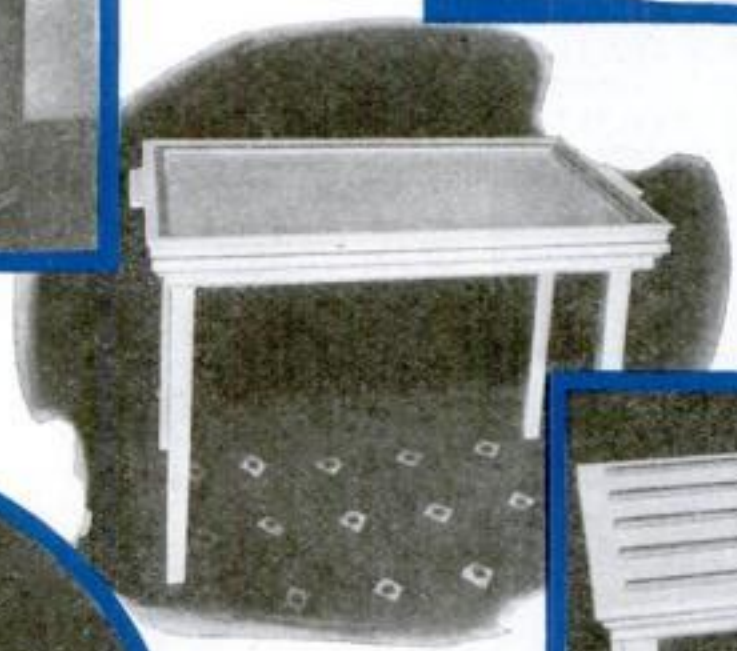


CLOSET HAT HOLDER. No screws are needed to fasten this hatrack to the shelves. A coiled wire base slips over edge of shelf, as seen in photograph at left.

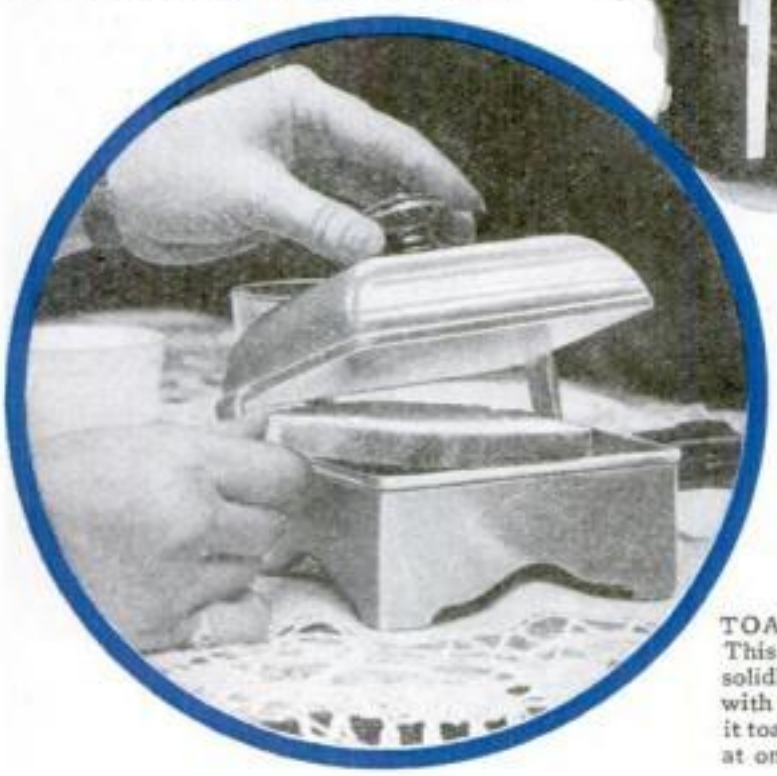
READY TO USE. Assembled, the novel electric lamp stove plugs into any outlet. Indicators on the side show whether bulbs are lit, and a switch regulates the heat to permit either rapid or gradual cooking.



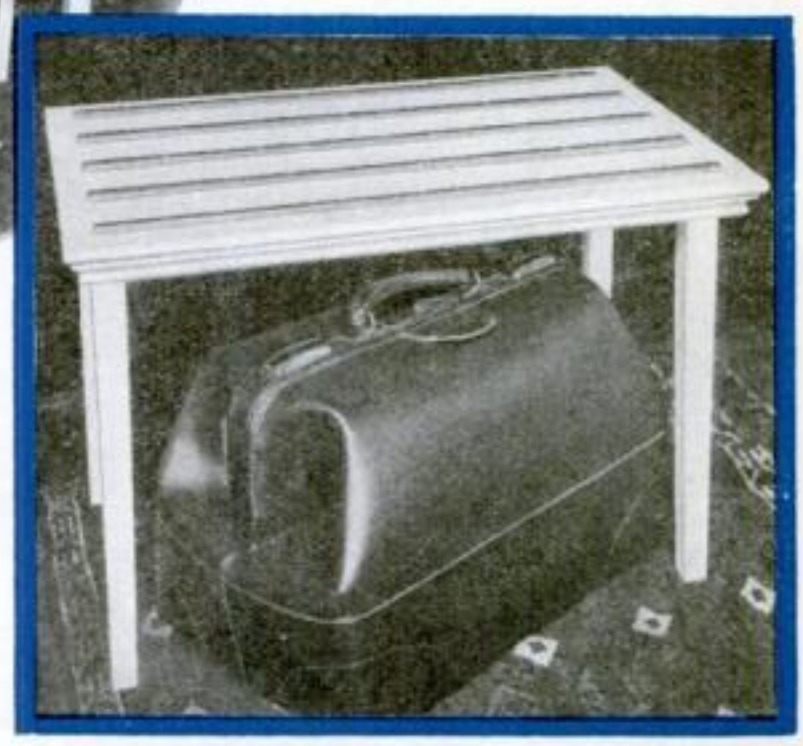
KEEPS GLOVES IN SHAPE. Something new in a wooden glove form has just appeared. The thumb is detachable and can be adjusted to any length of thumb, thereby making it possible for the form to give to the glove a natural shape, thus improving its appearance.



COFFEE TABLE. This folding table can be used in serving coffee, but the trays are removable and legs fold.



TOASTS BOTH SIDES. This electric toaster stands solidly on the table and with heat above and below, it toasts both sides of bread at once. No odors escape.



TWO PIECES OF FURNITURE IN ONE. This table is opened and ready to serve as a luggage rack in the guest's room. Above to left it is seen as a coffee table. It folds compactly.

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With a Pioneer of the Air

AVIATION claws at the mainsprings of popular interest because, to the greatest possible degree, it combines the features most stimulating to the human imagination. Deeds of daring, danger, success in the face of apparently insuperable obstacles, hair-raising stunts, all unite in a heart-throbbing appeal to people immersed in the humdrum of everyday modern life.

That is why we are sure that the story which appears on page 23 will be read with breathless interest by the vast majority of our readers.

Beginning with an ascent on a man-carrying kite at the tender age of eleven, way back in 1882, through forty years of flying in every known form of aircraft, and now, at the age of fifty-nine, still piloting planes with the best of them, we are certain that no man living has had a more colorful career in aviation than Horace B. Wild.

Think of actually knowing and associating with some of the greatest names in aviation! Chanute, the Wrights, Curtiss, Captain Baldwin, Roy Knabenshue, Santos Dumont of early dirigible fame, Lincoln Beachey, one of the fathers of stunt flying—all were known to Wild as well as you or I know our closest friends.

When you consider that Wild also is an electrical engineer and a construction superintendent who has supervised the building of apartments, skyscrapers, and amusement parks, his career seems like the Arabian Night's tales set to the modern tempo.

Pearl of Great Price—but Why?

AN INTERESTING fact is brought out in the article on pearl culture, which appears on page 44. Although pearls produced on the pearl farm are in most cases in every way identical with pearls taken from so-called "wild" or "natural" oysters, the culture pearls sell, grade for grade, at lower prices than natural pearls.

There is, apparently, nothing artificial about a culture pearl. It is produced by an oyster in precisely the same way and under precisely the conditions surrounding the production of the natural pearl. In appearance, chemical composition, and physical structure there is absolutely no difference between a culture pearl and a natural one.

In vegetables, conditions are reversed. The hot house or "cultured" variety usually brings a higher price than the wild variety. Nor is there any difference in the price of a silver fox pelt from an animal grown on a fur farm and that from a denizen of the forest who ended his career when caught in a steel trap.

The utilitarian value of a pearl is nil. Its sole value lies in its appearance. In this respect it is like a fine painting.

It is easy to understand why the product of a famous painter should command a far higher price than an equally good job by an unknown, but the buyer of a "wild" or natural pearl certainly cannot value the name of the oyster whose handiwork it is!

Blasting His Way to Fame

EVERY now and then along comes a man with the rarest of all qualities—the ability to break away from tradition and precedent and blaze an entirely new trail. To this honor roll of men with both brains and originality, we certainly must add the name of James W. Rickey, chief engineer of the Aluminum Company of America.

Rickey calmly pushed aside all the engineering data and established rules for building dams. He snapped his fingers at precedent and then literally blasted his way to an entirely new conception of how such a job could be done. See page 26.

Accidents Lead to Knowledge

A POST-MORTEM examination to find the cause of death is the climax that caps the stark tragedy of every fatal accident. Save to the morbidly curious, such proceedings cannot be other than depressing. Yet after all scientific knowledge often has been advanced far more by the information gained from an accident than would have been possible if no accident had occurred. That is because an accident not wholly due to human foolhardiness is always a breakdown test of some mechanical function.

From that point of view, the airplane crashes described on page 42 may well be termed scientific breakdown tests because in every case, with the exceptions already noted, some part of the plane was subjected to a strain that proved too great.

Airplane parts can be made stronger and better fitted for the tasks they must perform only by gaining a definite knowledge of how strong they already are under actual working conditions. The only type of airplane accident that cannot possibly teach us anything is one in which both the plane and the pilot disappear.

Are We Descended from Bugs?

NO dyed-in-the-wool searcher after the whys and wherefores of existence ever is satisfied unless he can piece together a reasonably plausible theory to explain any phenomenon about which nothing is known.

That is why a scientist's face always takes on a puzzled expression when you ask him how life originated on this earth.

He finds difficulty in constructing any theory of the origin of life on this or any other planet that fits with what we think we know about the origin of the planets themselves. If, as astronomy teaches, the earth and other planets were at one time part of those raging infernos we call suns, then the existence of any possible form of life at that time is too absurd for theory.

That leaves the scientist up against the hypothesis that life on this earth is merely the product of some kind of a chemical reaction that took place a long time in the past. Unfortunately for such a theory, however, there isn't a scintilla of evidence that any form of life ever was or ever will be formed chemically.

That is why two new discoveries may prove keys to the greatest secret of existence.

One of these was made by professor C. B. Lipman of the University of California. He recently announced before the National Academy of Sciences that he had discovered living bacteria deep inside rocks over two hundred million years old. That points to the possibility of the original spark of life having reached this planet lodged inside a tiny fragment of rock from the vast depths of outer space.

The other was made by Dr. Frank E. Lutz, Curator of Insect Life, American Museum of Natural History, New York, who subjected a variety of bugs, including ants, grasshoppers, beetles, and bees, to a vacuum probably more nearly complete than that of interstellar space. He found they survived the experiment.

He thus provided a possible solution to the other puzzle. If insects can survive a vacuum even for a short space of time, it is quite plausible to believe that they could adapt themselves to life on any planet where even a scrap of atmosphere remains. Intelligent beings of the armor-plated variety evolved from insects may therefore exist on Mars, Venus, and Mercury.

HELPFUL HINTS FOR RADIO FANS

How to Handle Vacuum Tubes

Twisting glass may loosen the cement and ruin tube—New way to stop radio while you phone

As the phone is lifted from the metal plate, it stops the radio.

RADIO vacuum tubes have been vastly improved in the last few years. Electrically they are now quite rugged. All types may be expected to give satisfactory service when used under the proper conditions.

Mechanically, though, the vacuum tube still remains a delicate structure of glass, insulating material, and frail metallic elements. Even a slight bump against the table may upset the spacing of the metallic electrodes sufficiently to convert the tube from a good one to a bad one. The bump may be so slight that it causes no visible damage and yet prove disastrous to the electrical efficiency of the tube.

Careless handling also may spoil a tube. Many a good tube has met an untimely end because the heavy handed owner used force instead of dexterity in putting the tube into the socket of the set.

The glass portion of the vacuum tube, which houses the electrodes and keeps out the air, is cemented into the molded composition base to which are attached the prongs. The hold of the cement on the glass is none too strong, and it is especially weak on twisting strains.

When you put a tube in, or take a tube out, of a socket avoid any twisting strain. Grip the tube as shown in Fig. 2, with the fingers down over the base, and apply the necessary push or pull to the base and not to the glass bulb. Figure 1 shows how *not* to do it.

Modern tubes should be inserted by a straight downward push and removed by a straight upward pull. Twisting is neither necessary nor desirable.

When the socket contacts grip the prongs on the tube tightly, it may take a considerable pull to get the tube out. In such cases the tube will not be damaged if the pull is applied to the base and not to the glass.

There is, however, one chance for trouble in such cases. The tube may come free so suddenly that the force of the pull will swing it up and slam it against some portion of the cabinet. Guard against this trouble by pulling in such a way that the tube won't hit against anything when it comes out of the socket.

Fig. 1. The wrong way to grasp a vacuum tube. Don't twist glass.

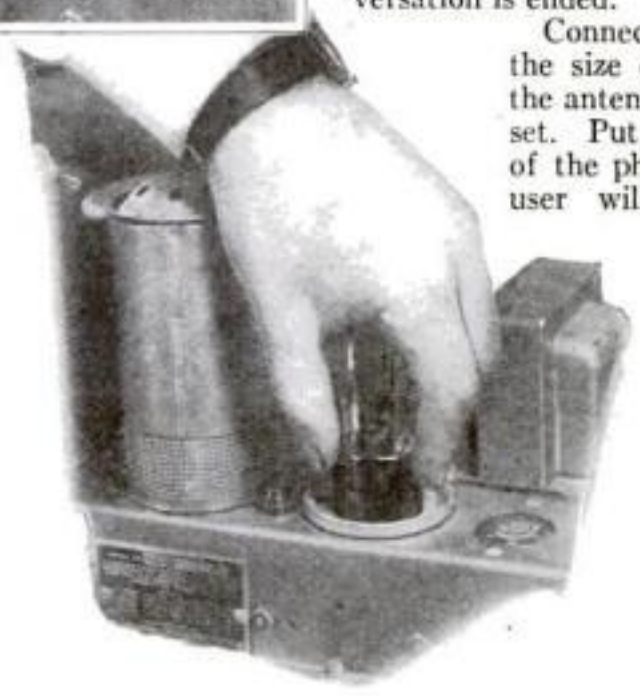


Fig. 2. Seize the tube by the base and lift it straight from socket.

Modern screen grid tubes are more likely to suffer from rough handling than other types because they have an extra cemented joint. The round metal cap at the top of the tube which forms the connection to the control grid is cemented firmly to the glass of the tube.

Connection is made to this terminal of the tube by means of a clip on the end of a flexible piece of wire. Apply this clip by pressing it straight down and remove it by pulling straight up, meanwhile holding the tube in the socket by pressing against the glass with the fingers of the other hand.

A B C's of Radio

A RADIO service man is, after all, only a human being skilled in one line of endeavor. He isn't a miracle worker nor can he accomplish things outside the realm of the physically possible. The radio service man can't do anything about static noises unless they are man-made, of a type that can be eliminated. If your set doesn't seem to be able to choose between stations on the lower end of the dial without considerable interference, don't blame the service man. It isn't his fault that there are too many stations operating at the same time. The service man can only put your set in the best possible operating condition.

NOVEL RADIO CUT-OFF

IT IS almost impossible to hold a telephone conversation in the same room with a radio receiver that is operating at normal volume. Consequently, in many households, the first job when the phone rings is to shut off the radio or turn the volume control way down.

Sometimes when the volume control is turned down in this way, the phone user forgets the radio at the conclusion of the conversation and the radio runs on for hours using current and wearing out tubes, but producing no music

A simple way to eliminate this difficulty is to arrange matters so that using the phone will automatically shut off the radio and start it up again when the phone conversation is ended.

Connect a metal plate about the size of the phone base to the antenna binding post of the set. Put the plate at the back of the phone table so that the user will naturally lift the phone off the plate in order to bring it near enough to talk into, and the job is done.

When the phone is not in use and is resting on the metal plate, there is a capacity pick-up from the phone line that will give plenty of volume on local and semidistant stations if the set is of the modern sensitive type. When the phone is lifted off the plate the pick-up is so reduced that the volume from the loudspeaker drops way down, thereby letting the phone user hold a conversation without ear strain.

The average tone control acts to suppress the high notes and overtones. Weaker high notes are cut out and strong ones sound thin and far away.

Radio Now Has Tone Control

Quality of Music or Speech over the Air Can Be Altered by Latest Attachment Developed to Improve Reception of Your Set

By ALFRED P. LANE

Shrill noises and nasal twangs may be cut out of radio program as you get it from your loudspeaker—This article tells how this is done and what you can expect from a set with a tone control knob—Bad music and mechanical imperfection make the new radio wrinkle desirable.

THE latest wrinkle in radio broadcast reception is "tone control." Many of the latest and most modern receivers are fitted with an extra knob which, when turned, does things to the tone of the music or speech coming out of the loudspeaker.

In many ways "tone control," or whatever fancy name is used to designate the function, is a most interesting development. Theoretically, it is a step in the wrong direction. Practically, it may prove quite useful under certain conditions.

What is tone control? How does it work? What good is it? These are the questions the prospective set buyer is puzzling over. In order to understand the answers to these questions it is necessary to dig into what tone really is.

Everybody knows that sound is carried by vibrations in the air, and most people know that low tones are carried to the ear by slow, long vibrations while high musical notes are brought by rapid, short vibrations. However, few persons seem to realize that you almost never hear a pure musical sound caused by one distinct rate of vibration.

Any ordinary sound that you hear from the rumbling of a truck to the high C of a soprano is invariably a combination of several different rates of air vibration. Furthermore, few persons understand that the only difference between a Caruso and a kerosene circuit tenor, or between a fifty-thousand-dollar violin and a ten-dollar one, is in the number and intensity of the faster vibrations which are harmonics or multiples of the fundamental tone frequency or rate of vibration.

Musicians speak of the superb timbre of a certain singer's voice or the liquid tones of a certain piano or violin. Such words are merely the technical jargon of the musician's trade. Scientifically, they are vague terms for certain pleasing combinations of overtones or harmonics which the singer or musical instrument produces in addition to the fundamental tone.

WHEN a band or an orchestra plays in the broadcast studio, a perfect riot of tone frequencies are produced. Literally thousands of different rates of vibration are forced onto the long-suffering air in the studio and the air obligingly carries this multitude of different vibrations to the microphones.

The entire attention of the studio technicians is concentrated on broadcasting, as nearly as it is physically possible to do so, an exact electrical reproduction of these thousands of air vibrations. And because of the state of perfection reached by modern broadcasting, a mighty good job is made of it.

So you have, streaming down your antenna, an electrical counterpart of the music that is being played or sung in the studio. If your radio receiver does its job, it will convert the electrical counterpart back into sound. Under such conditions you are likely to ask yourself what earthly use is tone control if the tone already is as nearly perfect as the present development of the art will permit.

THE answer is, of course, that tone control is about as useless as two tails on a cat when high grade performers are in the studio and the broadcasting is being transmitted and received as it should be. Attempting tone control under such conditions would be like trying to paint the lily or gold plate a gold coin. If the tone is right to start with, any juggling of the tone control will make it worse instead of better.

The true function of the tone control knob on a modern receiver is to give you a means of partially compensating for poor performance or bad broadcasting. With it, you can almost literally file the rasp from a singer with a voice like sandpaper. You can't make him or her sound like a good tenor or soprano, but you can make the sound a bit more acceptable to human ears. Similarly, you can take the edge off a brass band that is too strident and to some extent, at least, compensate for incorrect placing of the pick-up microphones in the broadcast studio.

Always remember that the use of the tone control cannot improve the tone when it is good, but it can make it less trying on the ears when it is bad.

In operation the tone control acts to suppress or reduce the intensity of certain frequencies or rates of vibration and allows other frequencies to come through virtually unaffected. There are several different methods by which this result can

A visual interpretation of how an orchestra would sound if all the low notes were cut out. The ordinary tone control cannot produce this effect.

be accomplished. Generally, however, the tone control takes the form of a fixed condenser connected across a critical point in the circuit by way of a variable high resistance.

Figure 1 shows a common arrangement. The condenser *D* is connected in series with a variable resistance *R* and across the secondary circuit of the first audio transformer in the radio amplifying end of the radio receiver. The fixed condenser *D* may have a value of from .001 to .1 microfarads, depending on how effective you wish the tone control to be. The variable resistance *R* should have a maximum value not less than 500,000 ohms.

WHEN all the resistance is in the circuit—in other words, when the contact arm of *R* in Fig. 1 is turned clockwise as far as it will go—the tone control has practically no action. As the contact arm is moved in a counter-clockwise direction, more and more resistance is cut out of the circuit, allowing more and more current to flow through condenser *D*.

A condenser passes rapid electrical vibrations or the higher frequencies much more easily than it does the low frequencies. Consequently, as you turn the knob of *R* more and more of the high frequencies that represent the higher notes and overtones of the music are sent through the condenser instead of on to the grid of the next amplifying tube.

The rasp in a tenor's voice, the edge on brass notes, and much of the static that bothers radio reception consists of vibrations or overtones of relatively high frequency, and this form of control therefore cuts out these frequencies before it begins to affect the lower or fundamental tones.

WHEN such a control is turned too far a voice that is broadly resonant with plenty of high and low frequencies in its make-up becomes dull and boomy. Similarly a speaker with a pronounced nasal twang can be made to sound quite deep although, of course, it won't be natural.

A control of this type is, in reality, a one-way tone control. All it can do is to cut out the higher audible frequencies. It cannot intensify the bass notes except by the indirect method of reducing the high notes and turning up the volume control to increase the intensity of the bass.

Some manufacturers are fitting their tone control models with a special audio system designed to overemphasize the higher tones. In such cases the neutral point for the tone control is not at the end of the motion but at some point where the by-passing of the higher notes is such that it reduces the net effectiveness of the amplifier to normal.

In any case the operation of such a tone control has a definite effect on the volume. The ear is naturally more sensitive to the tones in the middle and upper middle register, and the volume effect on the ear depends, therefore, on the intensity of these notes. When the tone control is operated to cut them out, the effect on the ear is a deepening of tone accompanied by a noticeable falling off in volume.

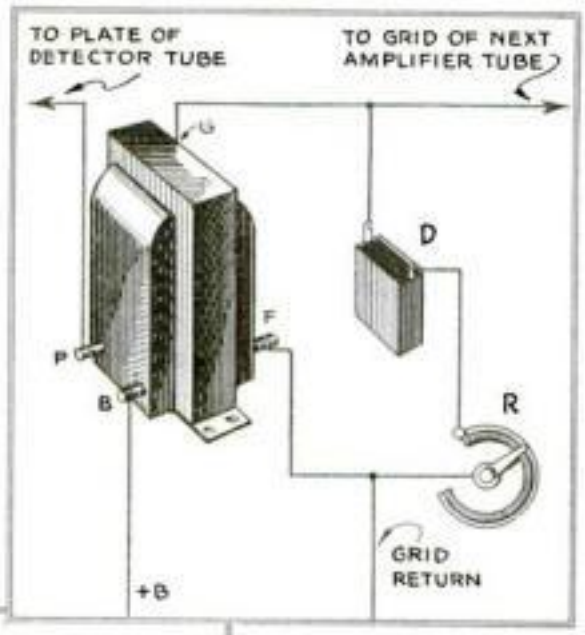


Fig. 1. A common arrangement of tone control to suppress high vibration notes.

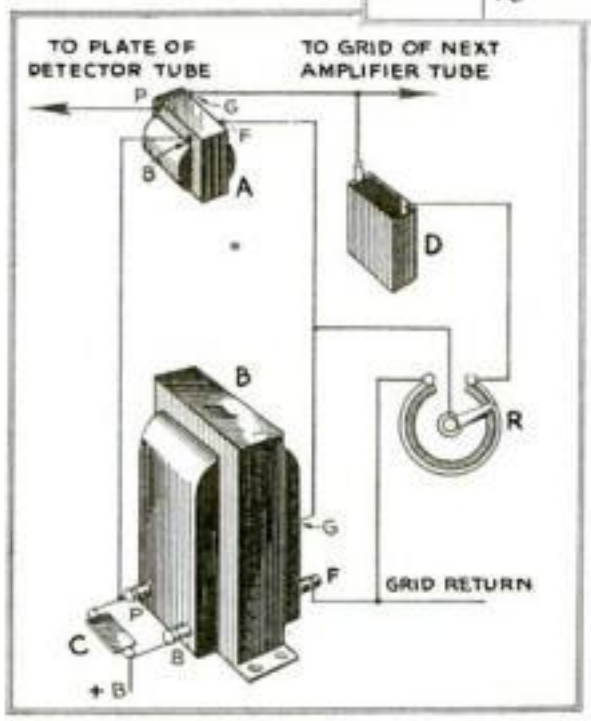


Fig. 2. Diagram of tone control in which high notes are cut out but volume is not decreased.

Figure 2 shows a novel method by which one manufacturer avoided this apparent effect of the tone control on the volume.

Two audio transformers, *A* and *B*, are used. *A* is a small cored transformer that passes practically none of the low tones. *B* is a large cored transformer especially designed and tuned by means of by-pass condenser *C* so that it overemphasizes the low notes and does not amplify the high ones.

The fixed condenser *D* and the variable high resistance *R* are the same as in Fig. 1.

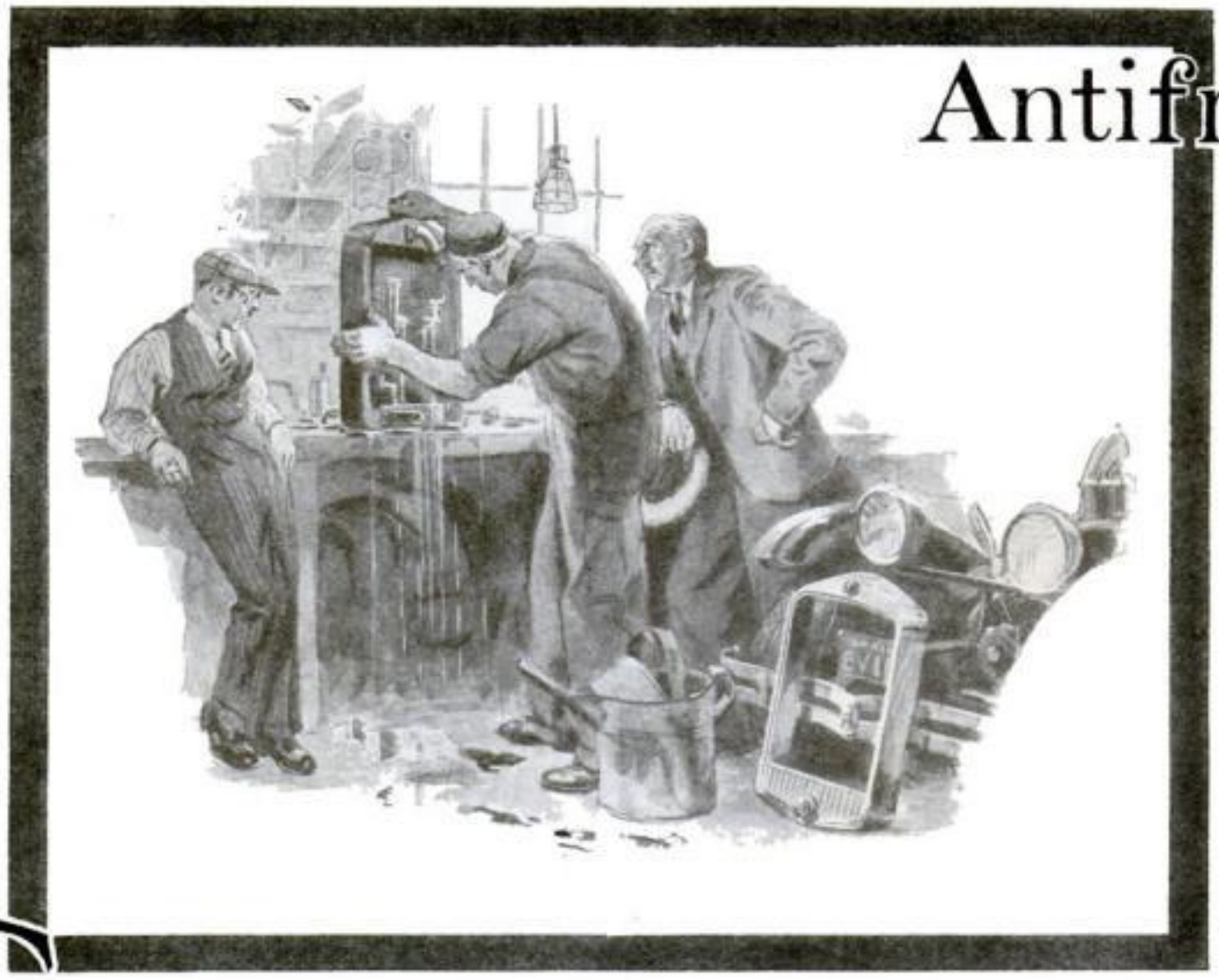
When the resistance *R* is turned all the way clockwise, the secondary of transformer *B*—the so-called "low-pass" or low note transformer—is shorted out and all the frequencies that get through are by way of transformer *A*, the so-called "high-pass" or high note transformer.

Bass notes under such conditions would not be heard from the loudspeaker at all. When the knob of *R* is turned all the way in the other direction, transformer *A* is completely by-passed by condenser *D* and transformer *B* does all the work.

IT IS obvious that at the intermediate settings of *R* the work will be shared between the two transformers and any desired combination of low or high note amplification can be obtained. Furthermore, as the knob is turned counter-clockwise to cut out more and more of the high notes from *A*, transformer *B* will actually amplify the lower notes to a greater and greater degree so that there is no apparent change in volume as the tone control knob is moved.

In brief the function of the tone control is to change the relative intensity with which the loudspeaker reproduces the low, medium, and high audible frequencies. This is accomplished either by progressive suppression of the various frequencies beginning at the top of the scale or by the use of some (Continued on page 154)

What You Should Know About Antifreeze



"Any kind of a salt solution is bound to be bad," Gus said. "It eats away the cylinder or radiator walls or both."

Gus Tells How to Protect the Cooling System of Your Car During Cold Weather

By MARTIN BUNN

"HELLO, Gus!" called Jim Backson, the asthmatic proprietor of the town's commercial hotel, as he steered his car into the Model Garage one frosty morning.

Gus Wilson, half owner and auto mechanic of the establishment, unwrapped himself from around the motor on which he was working.

"Well, Jim," he said, "what's eating the bus this morning? Frozen radiator, maybe?"

"Naw, nothing like that," Backson puffed as he squirmed out from under the steering wheel. "Just a tiny little leak you ought to be able to fix in a couple of minutes."

Gus walked over and inspected the radiator. "Ain't no such thing as a little leak in an auto radiator—leastways when it comes to getting it fixed," he observed. "Generally takes just as long to fix a little one as it does a thumping big one. Got time to wait while I do the job?"

"Yeah, I guess so. Business is pretty slack right now," Backson grunted, tossing his overcoat into the car and draping himself comfortably on the edge of the workbench.

"Be sure to save that antifreeze solution, Gus," he cautioned.

The veteran auto mechanic shoved a pail under the drain cock and turned it on. He had to poke it with a piece of wire before the flow started.

"Say, what kind of slop is this, anyhow?" he growled, eyeing the slow dirty trickle.

"Oh, that's some swell antifreeze I grafted off a fellow who stopped at the hotel," Backson replied. "He says it's great stuff. Guaranteed not to freeze no matter how cold it gets!"

GUS merely grunted and made no further comment as he removed the radiator shell and the radiator itself.

"Now we'll give it a real good cleaning out," he said as he carried the radiator over to the washstand and attached a special fixture to the lower hose connection.

Gus Says:

IF A car has bum springs, you can buy special shock absorbers till your purse goes flat without improving the riding quality so's you can notice it. Of course if your trouble is that you bounce up and down too far when you go over bumps, a good shock absorber or snubber will cure the trouble; but if your car has springs only fit for an ice wagon, snubbing 'em isn't going to make 'em more flexible and easier riding.

"What's that gadget?" Backson inquired.

"Latest thing to clean radiators," Gus replied. "Water goes in the big pipe and the little one is connected to the air pressure line. Shooting the air in with the water in short bursts fills the radiator with a churning mixture of water and bubbles that loosens the sludge and rust lots better than the ordinary flushing out—'specially when you shoot the water and air into the bottom of the radiator. I'll do the cylinder jacket the same way when I get through with this."

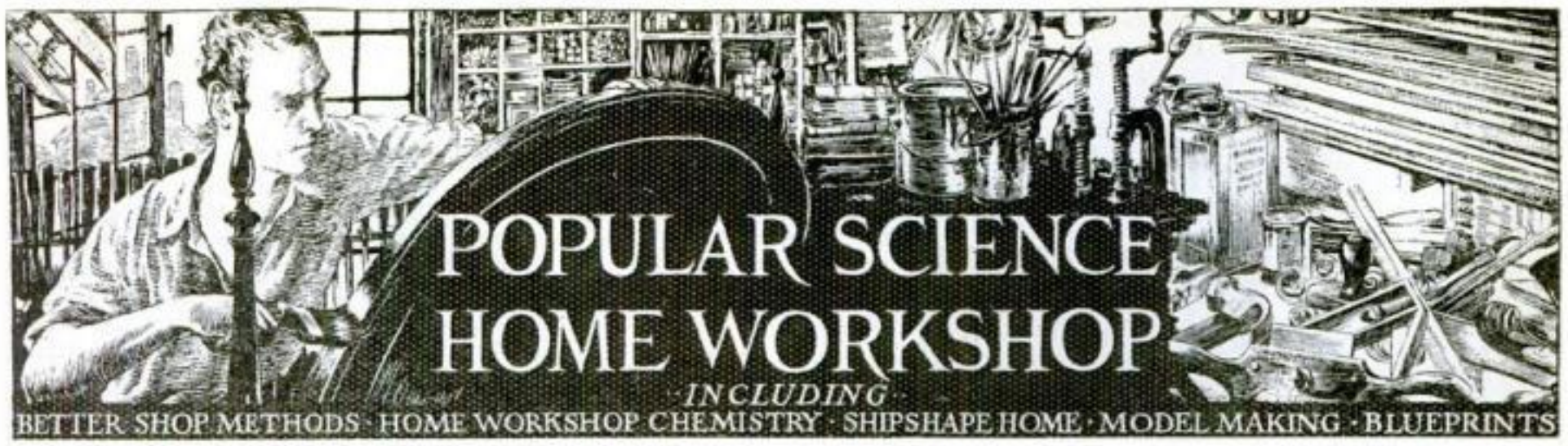
"Is it very complicated inside?" Backson asked.

"No, it's only a casting with a passage cored in it so the stream of air comes out of a fine nozzle right in the middle of the stream of water."

WHEN Gus noted that the water issuing from the top of the radiator was clear, he replaced the water and air injector with a cork, filled the radiator with water and set it up on the bench.

"Jiminy!" gasped Backson. "You've put the whole works on the blink. Look at it leak. Must be at least a dozen holes. What happened?"

"That's what that 'swell' antifreeze did," Gus grumbled as he gently poked at the leaks with the end of a screw driver. "See, the metal's all eaten away. Cleaning it uncovered a lot of places that were jus' held closed by *(Continued on page 144)*



Here it is—Our New Model *Destroyer 327*

Navy Department plans were used in designing this 31½ in. long model.

By
CAPT. E. A. McCANN

This tiny fighting ship, developed in response to readers' requests, may be built for exhibition or equipped for sailing.

WHEN we asked our readers recently to tell us what kind of ship model they wanted to make next, they suggested all sorts, but the preponderance of votes was for a change— for something more modern than the previous ones, and the favorite was a destroyer.

Well, here it is! In this and the following issues, we shall tell how to make one of the most recent United States destroyers, which can be built with full details as an exhibition model or fitted with some form of motive power for sailing.

These destroyers are remarkably good-looking. They have a sleek ferocity that is fascinating. Their job is not to stand up and be hammered, but to hit and run—to use cunning to get in their deadly blow and vanish.

In their uniform gray color there is nothing to distract from the lean silhouette. To see them at full speed with a bow wave as high as the bridge or sliding along the side of a sea, looking as if they never would come upright again, is enthralling. But don't go aboard unless you want an attack of seasickness.

The Construction Department of the United States Navy was kind enough to furnish us with the building plans of the U. S. S. *Preston* (D.D. 327). These plans, which were 7 ft. long, we have reduced to model making terms and from them have built a careful scale model. How we did it we are about to tell you. If, however, you know of easier or better methods do not hesitate to use them. After all, your success will depend largely upon your own ingenuity.

The *Preston* was named for Lieutenant Samuel W. Preston, who was born in Canada and died in battle while leading his men in the attack on Fort Fisher in 1865. She has just been scheduled for dismantling under the recent treaty. She originally cost about $1,000,000. Although the lines are of this particular ship, the differences between her and others of her class are so slight that on a model they would be negligible.

The over-all length of the *Preston* is 314 ft. 4½ in.; molded breadth, 31 ft.; molded depth amidships (line 9), 20 ft. 8 in.;

designed draft, 9 ft. 3½ in.; displacement at designed water line, 1,204.5 tons.

This to the scale of 1/10 in. equals 1 ft. gives us a model 31½ in. long. It is a convenient length for an exhibition model; the scale is large enough to enable us to embody the important details, but not so large as to prove cumbersome in a room.

Those making this model would be well advised to get Blueprints Nos. 125, 126, and 127 from the Blueprint Service Department of POPULAR SCIENCE MONTHLY (see page 119). On them will be found the exact lines for the hull and all details to the above-mentioned scale of 1/10 in. equals 1 ft.

Each numbered line is the shape of the hull at the corresponding station point on the sheer plan.

Though a working model can be made to this size, as is mine, it is, however, too small for real efficiency, because these destroyers are inordinately long in comparison to their depth and width. On this scale the model draws but a bare 1 in. and is only 3 in. wide. When the hull is hollowed to an average of 1/8 in. thick, only 1 lb. will sink it to the load water line, so motor, deck, and fittings must not weigh more than that. Other factors are that she will be as cranky (top-heavy) as a real destroyer, and waves ¾ in. high will slop over the afterdeck.

Therefore, if you wish to build a working model, we advise making it at least half as big again as the plans. This would allow the hull to carry more weight, and the weight can be kept low to increase the stability. It has been suggested, indeed, that a fin keel could be designed with a water-tight container at the bottom in which flashlight cells could be carried, taking the place of the lead weight on a sailing model.

Now to work. You will need four pieces of white pine, a full ½ in. thick, 3¼ in. wide, and 34½ in. long, as well as one piece for the top 11 in. long and one full-length piece for the bottom, ¼ in. thick. These are cut to the lines of the half-breadth plan (lifts *A* to *F*), but saw slightly outside your marks. All except the bottom piece can have their centers jig-sawed out to within ¼ in. of the size of the piece below. Leave a sufficiency on the stern for the cut-up and for supporting the propeller shaft.

Glue these pieces together, noting that the fore-and-aft line and the vertical construction lines on all coincide. The top-piece can be more conveniently glued on after the others. When the glue is thoroughly dry, shape the outside to the body plan lines by cutting cardboard templates to those lines and shaving down until they fit the hull at their respective positions as shown on the sheer plan. Note that there is a slight tumble home in places; that is, the widest part is lower than the deck.

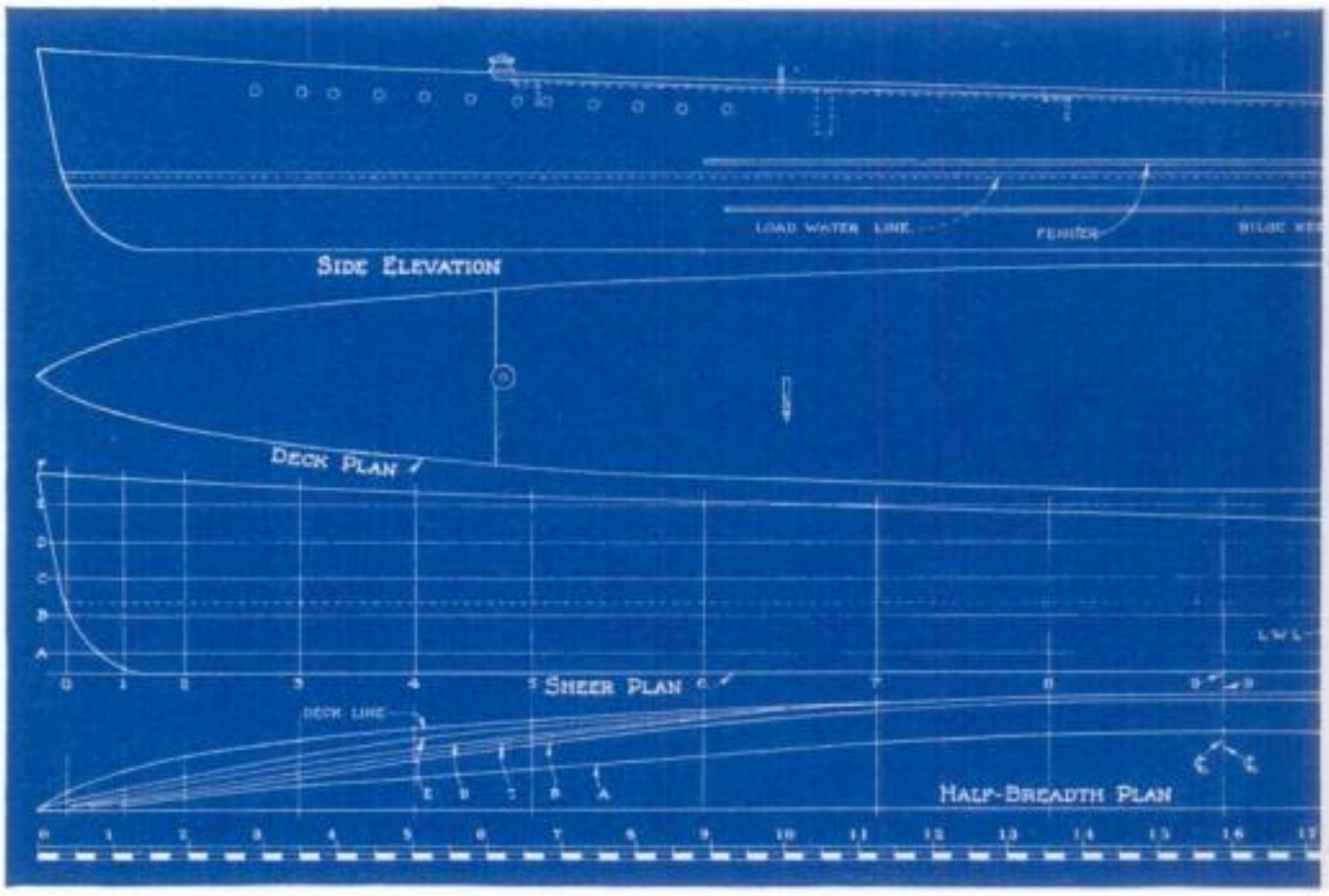
The shape of the stern is rather peculiar. It will be noted the keel stops just forward of line 15, and from there cuts up at half a right angle, the flat part underneath being about ⅜ in. wide where it begins and tapering to the stern-post. The stern is what is called a "cruiser stern," which projects farthest at the water line. The radius of its curve is 30 in. The skeg through which the rudderpost passes may be left on in the wood or be a small plate screwed on to the hull.

The bow is of modern design and has a slight "bulb." It thickens towards the keel. This is said to make the water flow better to the propellers.

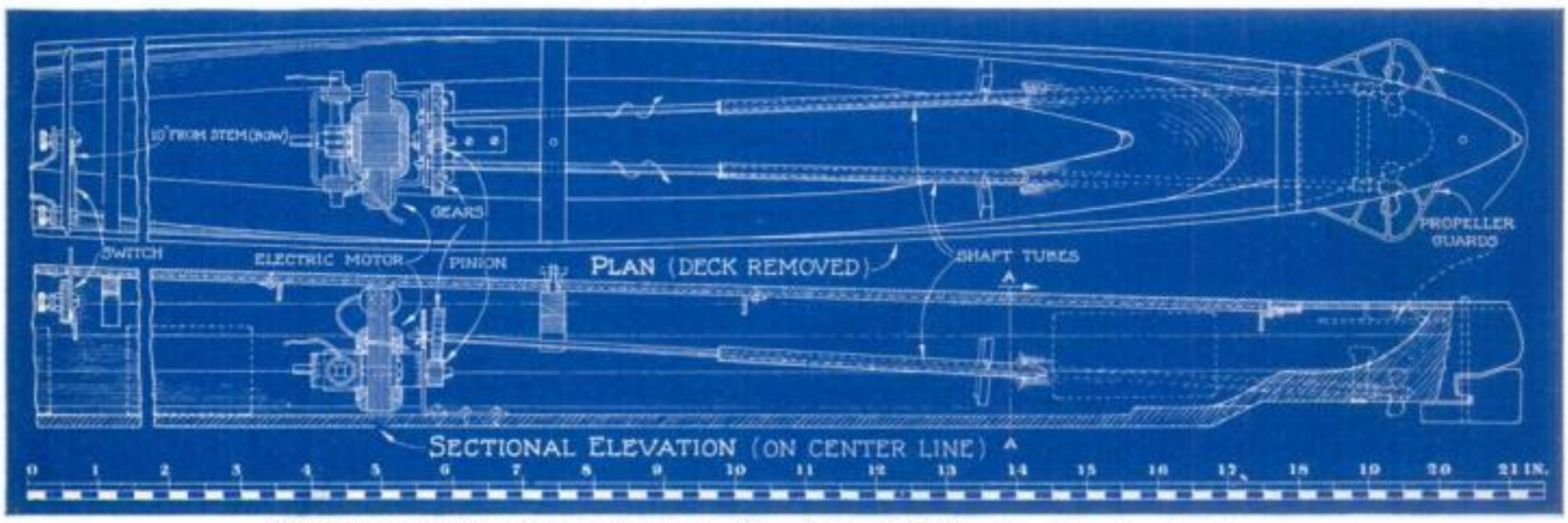
For the deck, if it is to be an exhibition model, cut a slight rabbet all round the inside of the hull, put some deck beams across, and fasten your deck to these, making it slightly higher in the center than at the sides. It is flush; that is, on one level all the way along.

If it is to be a working model, lay a similar deck on the ends only; then fit another deck to meet these, but instead of fastening it down to the deck beams, get some short bolts to project through the beams and the deck, with nuts above to screw it down. For a small model these can be in the center, but a larger model should have from four to six at the sides. If they are painted gray, they will look like ammunition hoists.

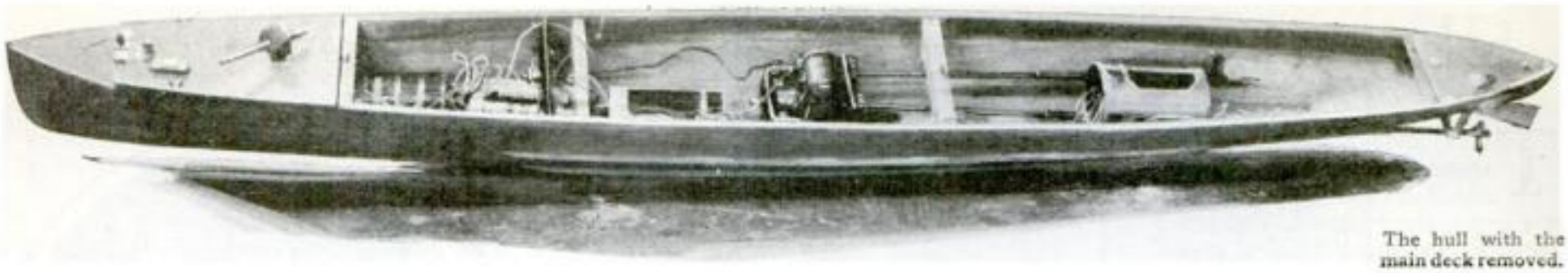
This removable deck should be made of a piece of ⅛-in. three-ply wood. In this case the rabbet should be cut around the underside of the deck instead of in the



The forward half of the side elevation and the deck, sheer, and half-breadth plans, drawn to the same scale as the body plan shown above. The other half of these drawings appears on the facing page.



Two views to show the arrangement of the machinery in Captain McCann's model—a tiny electric motor geared to turn the twin propeller shafts. Compare this with the photograph at the top of the next page.



The hull with the main deck removed.

hull so that it will fit in tightly. To stiffen this loose deck, some small brass angle irons should be screwed underneath.

Various kinds of machinery can be used for propulsion. A little steam engine would, perhaps, be the best, but it is the most difficult to make and install. Clockwork or elastic bands would work, but what I did was to install a 6-volt D. C. electric motor of standard make which weighs only 5½ oz. and will fit in a 2-in. diameter tube. To this are connected four flashlight cells in series, with which it works very well, but not for very long.

The essentials for this or any other machinery are a plate to fasten it to the bottom or sides of the hull and some method of gearing the driving mechanism to the two propeller shafts (see the midship section). In the model illustrated a plate was screwed to the frame of the motor so that it just clears the bottom of the hull. In the plate was drilled one hole for the motor shaft and two for the propeller shafts, their positions being governed by the gears used. As the speed of the motor is 3,000 R.P.M., a ⅜-in. gear wheel was soldered to the motor shaft and ¾-in. gear wheels to the propeller shafts, reducing the speed one half. It was necessary to drill the motor shaft slightly off center so that its gear wheel engages only one of the larger gear wheels. The shafts were made of 3/32-in. brass rod, and the shaft tubes of ordinary ⅛-in. inside diameter brass tubing.

The shaft tubes are sufficiently long so that the inside ends are above the water line, and no stuffing boxes are required. To line them up, I bored out fairly large holes in the hull at the right position, and then moved the motor along the hull until I had the shafts projecting at the correct angles. I fastened the motor down in this position and then packed around the shaft tubes with plastic material until they were rigid.

The inner ends of the shaft are filed down a bit, leaving a shoulder to act as a thrust bearing. Then, just inside the plate, holes are drilled through them to take cotter pins, which prevent them from sliding out.

To make the struts, fit a short piece of the stern tube on each shaft; then bend a piece of sheet copper around this and solder it on. The upper end is left with a small flange, which is bent to the shape of the hull and screwed on. The horizontal part goes right across the keel, screws to it, and comes up around the other side. The ends of the shaft are next cut off to the right length and ¾-in. propellers fitted on. The propellers should turn up and outwards; be careful, therefore, that your motor turns in the reverse direction.

Above the propellers are the guards. These are made from brass wire with other brass wire soldered to them and bent to the correct angle, the ends being forced into holes bored in the hull.

The rudder, it will be noted, is of the balanced type. To make it, I sawed down the middle of a piece of ⅛-in. brass rod to form the slotted rudderpost, and cut a piece of sheet brass for the rudder. Bore up through the skeg and through the hull so that the rudderpost is a tight fit. The rod will have to be put in position before you can place and solder the rudder itself in the rudderpost slot.

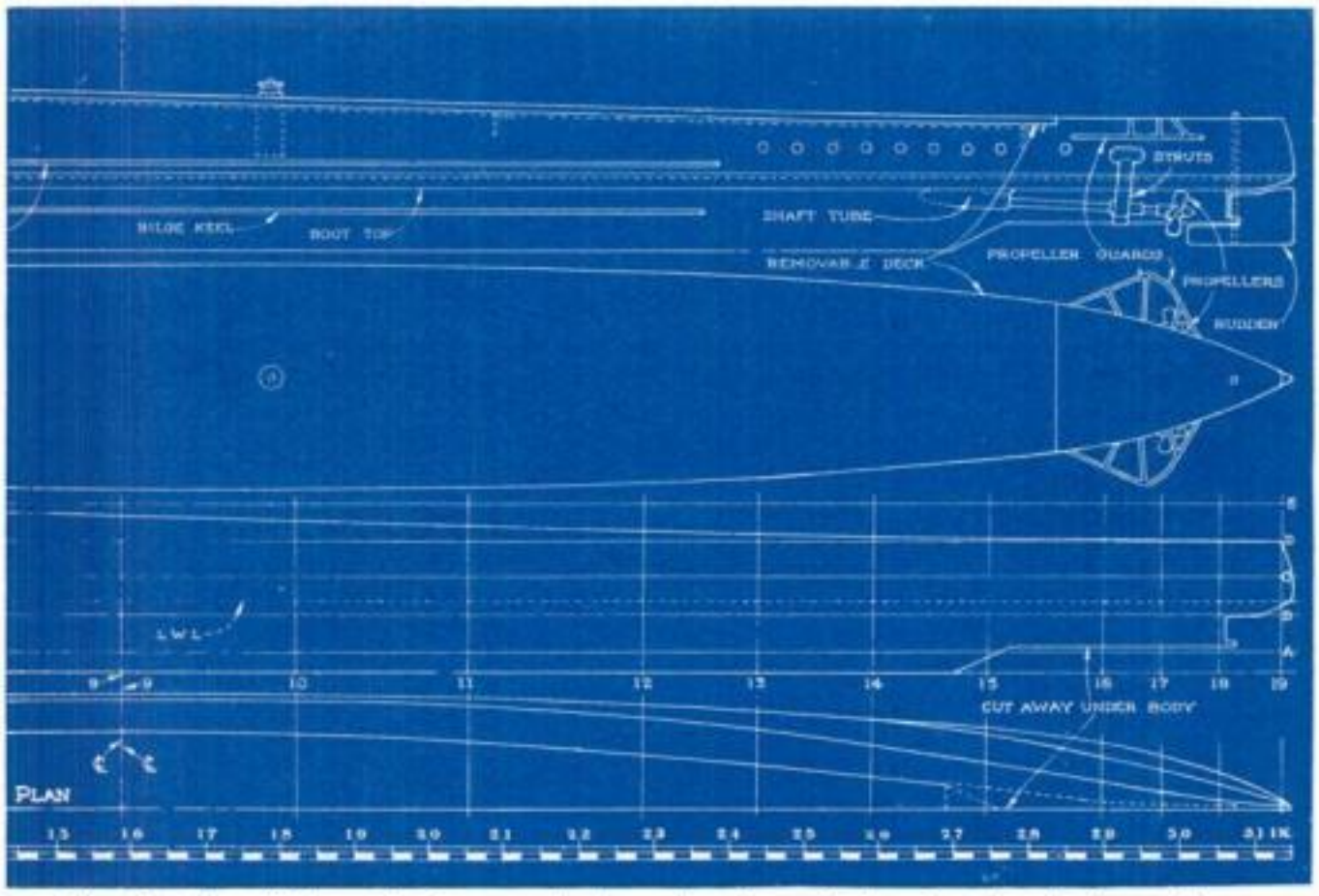
To complete the hull, it should have chafing pieces or fenders just above the boot-topping (see the midship section). These can be strips of wood glued and nailed on.

Below these are the bilge keels, also made of wooden strips. These show straight on the plan, but in reality are curved to conform with the horizontal line of the hull.

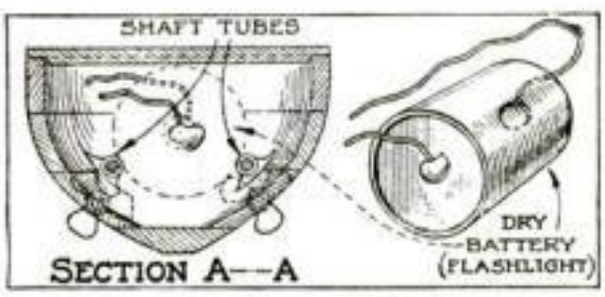
The portholes I made by pressing into the wood with a clip intended for making holes in loose-leaf notebook sheets.

This completes the hull. It should be given two or three coats of flat white paint, rubbed down. The bottom, representing antifouling paint, is colored with a mixture of light red and Indian red. The boot-topping is black. Above this everything is gray. There is a lacquer paint of the right color, but I prefer artists' oil paint because it goes on more smoothly and dries with a dull finish.

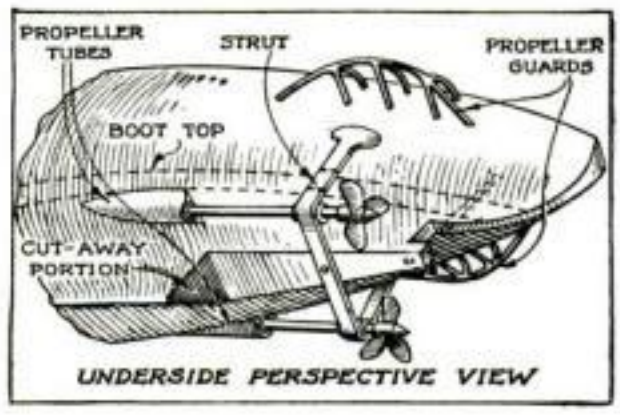
Next month we shall start making the deck fittings and deck houses.

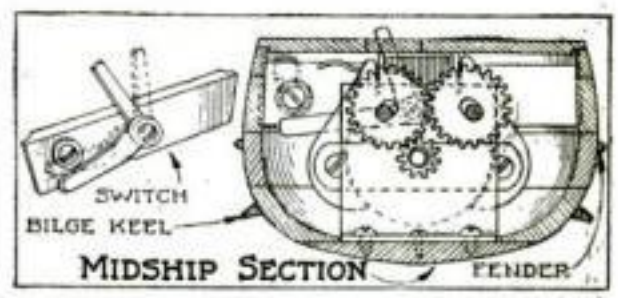


These drawings slightly overlap those opposite (note the scale numbers) and continue the lines to the stern. All these drawings appear full size on POPULAR SCIENCE MONTHLY Blueprints Nos. 125, 126, and 127.



A section through the hull on the line *A-A* of the drawing at the bottom of the preceding page, and the type of flashlight cell used.





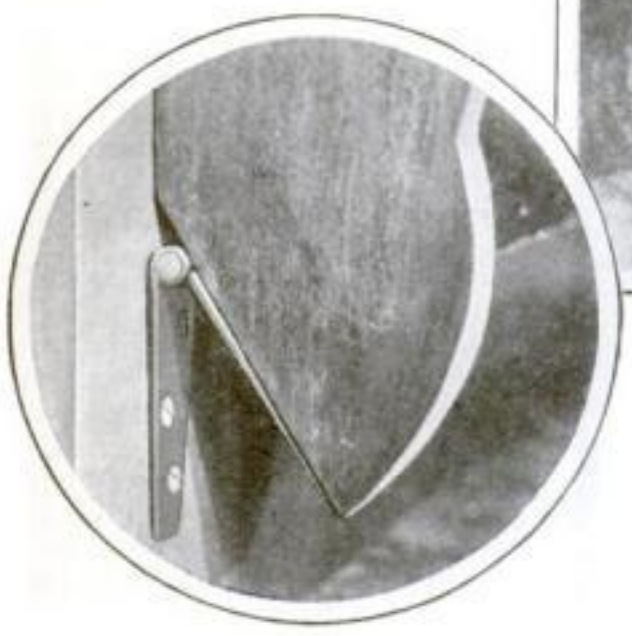
At left: Sketch showing underside of stern. *Above:* Section of hull on the center line amidships, and a sketch of the motor switch.

Shoe Holder Hinged to Closet Door

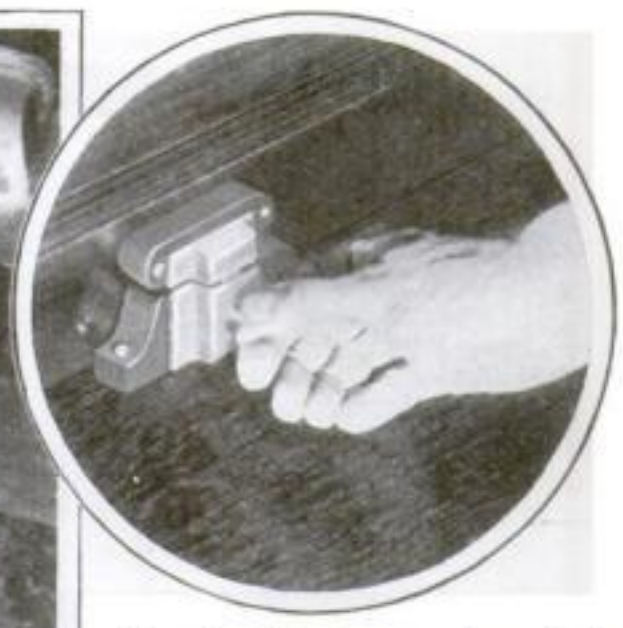
THIS shoe holder, which is mounted on the inside of a closet or other door, provides a completely inclosed, dustproof chamber for three pairs of shoes.

The ends are cut from ¾-in. wood, or from thinner veneered paneling; the other pieces are thin plywood or composition board. The shape of the ends is such that the container, normally resting against the back of the door, will open outward.

Two fairly heavy strap hinges, suitably painted, are used to fasten the rack to the door. In the rack shown, the strap hinges had to be modified slightly by cutting off one end and drilling a new screw hole, because they were too long. The hinge pins must be removed in mounting the holder to the door; otherwise a screw driver cannot be used in the restricted space. A cupboard latch, mounted on two blocks of wood as shown, serves to hold the container in the closed position.

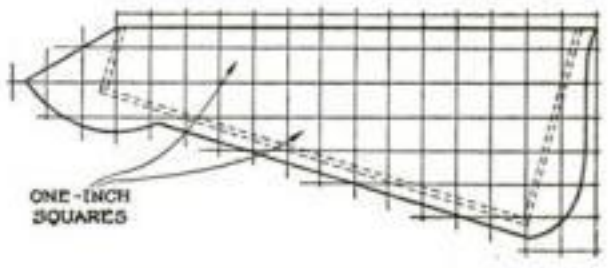


The novel shoe box when swung into the open position, and (at left) a close-up of the hinges.



A cupboard latch mounted on suitable blocks will keep the shoe holder closed.

Along the interior surface of the large side of the case is a wood strip over which the heels of the shoes rest, and a strip of cloth is provided to form a pocket for the toes and keeps them in place.



End view of the shoe box with 1-in. squares to aid in laying out the shape full size.

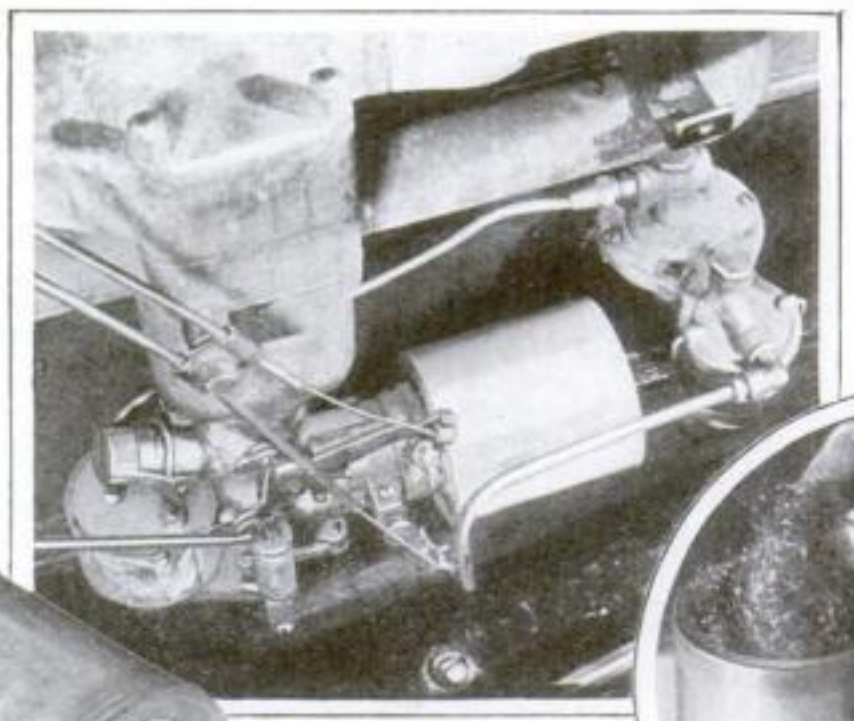
Homemade Auto Air Filter Keeps Out Grit

BY CONVERTING a small tin can into an air strainer for the carburetor of your automobile engine, you can reduce the wear caused by dust and grit that enters with the vaporized fuel. The filter unit is attached over the carburetor air-intake opening.

Select a tin can, preferably similar to a molasses container, which has a wide rim around the open end, and clean it thoroughly. In the bottom cut a hole of the approximate size of the carburetor air-inlet opening. The construction of the carburetor determines whether the can should slip over or into the opening, and it may be necessary to solder a collar around the hole in the can bottom.

Cut two circular pieces of wire screen, the finer the better, to fit snugly inside the can. Place one in the bottom, and introduce into the can the filtering material, which may be excelsior, flax, or some similar substance impregnated with neat's-foot oil. Do not use too much oil. The second disk of screen wire is then forced into the can and held by the rim around the edge. Finally, paint the filter and fasten it in place.

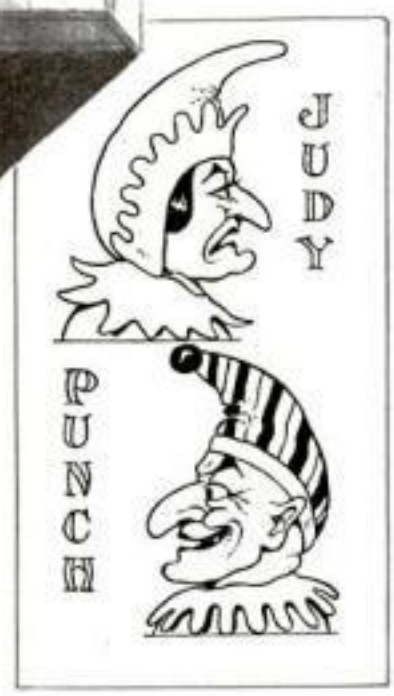
If the running of your engine indicates that the air supply is being reduced too much, take out some of the filling. The fibers should not be packed too closely together; it does not take much to filter the air.—ERVIN WALTERS.



Above: The filter in place over the carburetor intake. *At left:* The completed strainer and the air-intake cover that it replaces on a certain type of carburetor. *At right:* Inserting the filtering material, which is impregnated with oil.

Toy Punch and Judy Show

By DON HOUSEWORTH



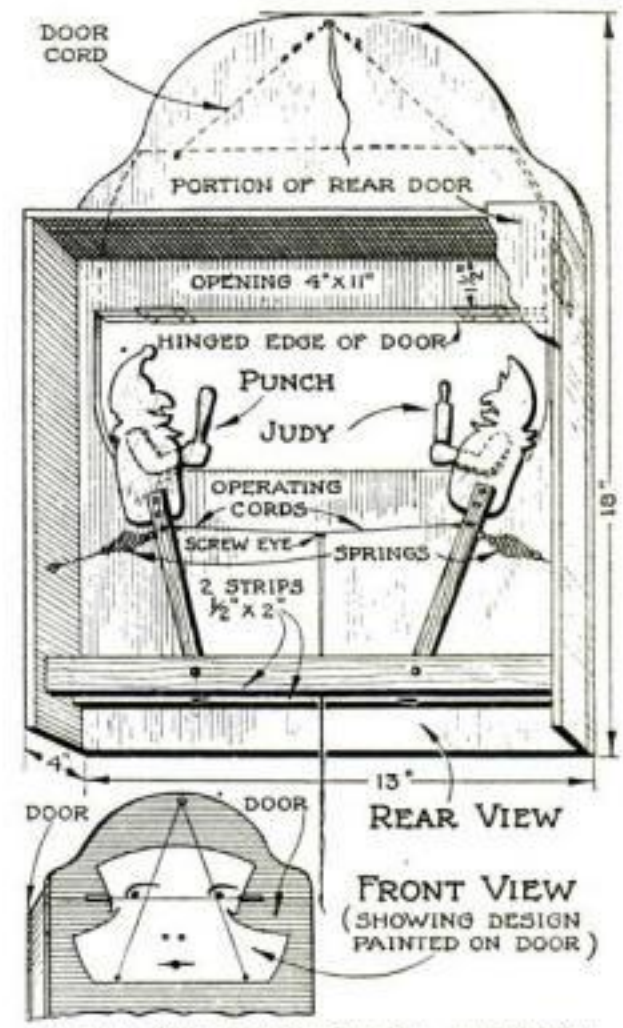
Because they can work it themselves, small children will enjoy this toy theater. At right: Full size heads for the Punch and Judy figures.

THE once well-known and always highly amusing Punch and Judy show can be reproduced at little or no cost in a simple model made as illustrated. It is a delightful toy for Christmas.

Two strings and two bird-cage springs control the figures as shown; or, even simpler, a taut cord is run from Punch to Judy and a single operating string is tied to its center, no screw eye being used.

The Punch and Judy figures, which may be cut from soft wood, are attached to strips ½ in. square and 7 in. long. These are pivoted at their lower ends between two strips of ½ by 2 in. material fastened across the box near the bottom.

The front of the theater, when closed, can be painted to present the face of a child or a clown. Red lacquer makes a good finish for the remainder of the outside, and yellow or white should be used inside except on the front door. This should be black with the words "Punch and Judy" in bronze, so arranged that they flash into view when the door is raised by its cords. In the original model the letters were sawed from thin wood and glued on the door.



A rear view showing interior construction, and a smaller sketch of part of the front.

Cabinet for Lathe Tools

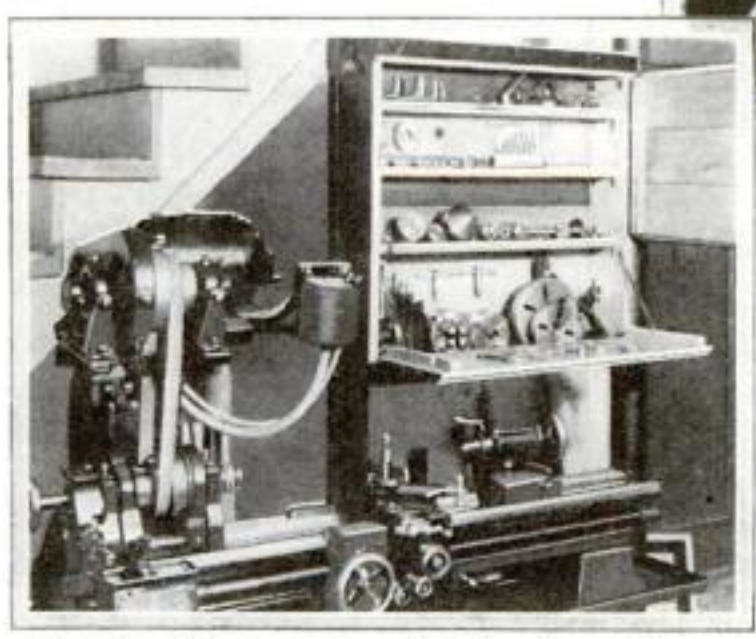
FACED with the problem of finding a place for the special tools and accessories used with my engine lathe, I decided that the only solution was a special cabinet that would combine complete protection with maximum convenience. The result is shown in the illustrations. The cabinet is constructed from 1-in. whitewood throughout. Consequently it it so strong that it will not sag with the heaviest load of tools—and lathe tools are heavy!

Every tool is instantly accessible and yet when not in use is protected from dust or accidental damage.

The peculiar door arrangement is a decided advantage. The lower door swings down to the horizontal position to form a tray, and the cabinet is so placed that this tray is directly over the tailstock end of the lathe bed. It forms the handiest sort of a place to put calipers, "mike," wrenches, and the other odd tools that are used on even the smallest job. It keeps them out of the way of flying chips and oil and makes it unnecessary to clutter the carriage and ways of the lathe with these small tools.

By liberal use of the dado head on the power saw in my home workshop, I succeeded in making the cabinet absolutely dust tight. The boards making up the back of the cabinet are tongued and grooved together, as are the boards used for the doors. When the lower door is swung shut, the tongue on the outer edge of the upper door overlaps the rabbet in the outer edge of the lower door and holds it shut. There are no cracks between boards through which any noticeable amount of dust can filter.

The lower door is closed first, and the upper one locks it with a dustproof rabbeted joint.



When the cabinet is open, one door drops down to form a convenient shelf for whatever tools are in immediate use.

The size of such a cabinet can, of course, be made to suit the number of tools you own or expect to own in the near future. The cabinet shown is 30 in. square by 6 in. deep. Approximately 60 ft. of 1 by 6 in. whitewood were used in its construction.

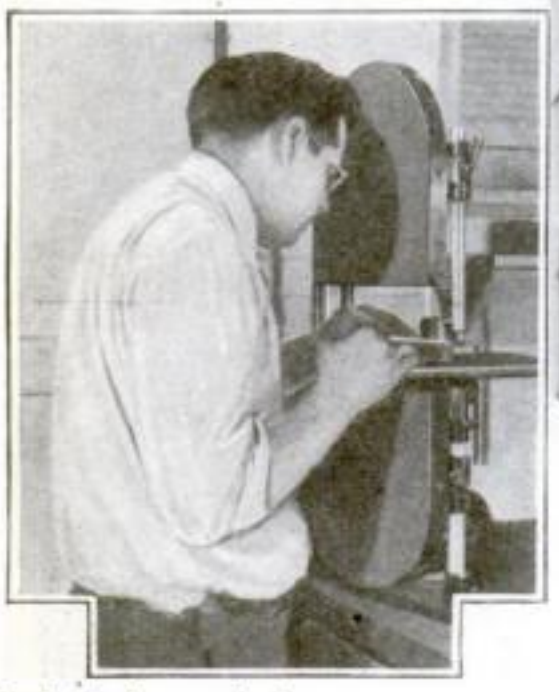
The outside is smoothly finished with several coats of black brushing lacquer and the inside with several coats of clear brushing lacquer to prevent the wood from becoming stained with oil from the various tools and accessories.—F. D. R.

Making Your Home Shop Safer

Seven pointers on the proper way to install and use small bench-type motorized woodworking tools

Safe as motorized home workshops are, there are certain simple precautions that should be observed. Some of these are illustrated below by courtesy of the National Safety Council

Both wheels on a band saw should be guarded on both sides to protect the arms, hands, and head. Never hang anything near a band saw such as the saw and the coil of wire shown in the top photograph. The illustration directly above shows a guarded band saw and a worker who has followed the first rule of safety by rolling his long shirt sleeves.



Right: Tools and materials placed on a shelf over a motor-driven machine may fall into the moving parts and be thrown, causing serious damage. Be sure that your saw is well guarded and that the table is steady. Another hazard shown lies in the folded fingers of the left hand.

Unguarded belts and easily accessible switches may prove a source of danger where children are concerned. Provide a main switch, out of their reach, and throw it when leaving the shop.

Tools hanging over a lathe are particularly dangerous. In the photograph directly above there are no tools that can fall into the machine, and the belt is guarded, making it impossible even deliberately to push a tool into the moving belt. Here again the precaution of rolling up long sleeves is of importance.

Left: Notice the guard over the top and along the sides of the saw, and the absence of anything that can fall into the machine while it is running. There is also a sheet metal guard placed over the belt; this can be easily removed when it is necessary to get at the belt.

A Gay Cabinet to Hold Christmas Toys

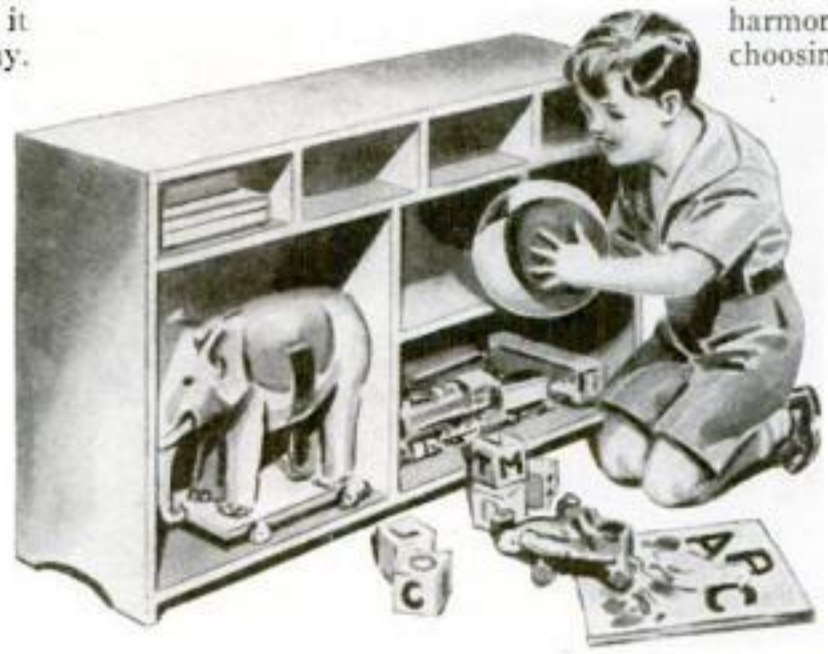
By R. F. JENNINGS

THIS distinctly modern looking child's cabinet provides a space for every toy and in addition makes it easy to teach a child to put his toys away.

The pigeonholes are of assorted sizes. Since each is enameled or lacquered a different color inside, the boy or girl soon learns to put the blocks in the "red place," the teddy bear in the "blue place," and so on. It becomes a pleasure to the child to show mother how nicely the toys have been put away.

How the cabinet is constructed is made clear in the drawings. Three boards of pine or other softwood 13/16 (nominally ⅞) by 12 in. and 8 ft. long, and a piece of 3/16 in. thick fiber wall board 25 by 48 in. are needed.

The color arrangement indicated will prove a pleasing combination, but if some other scheme is preferred, a color harmony chart will be found a help in choosing the bright colors for the pigeonholes. The outside can be stained and varnished, or it can be lacquered.



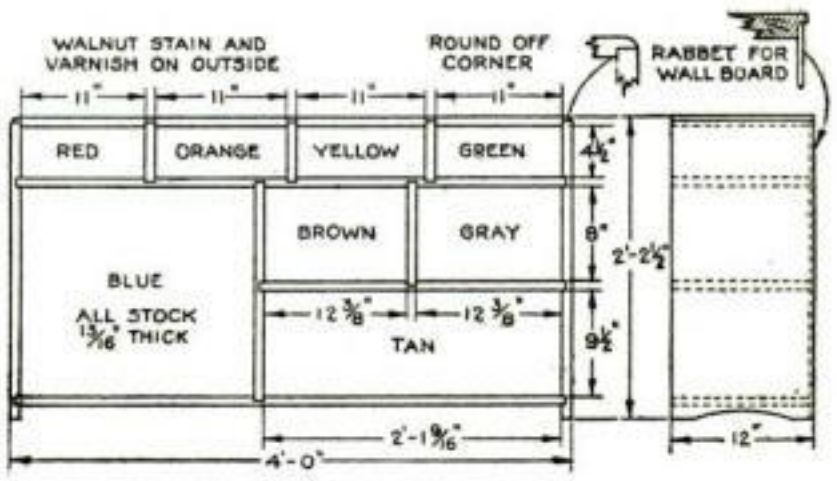
The wall board back of the cabinet can be quickly tinted on both sides with a little walnut stain applied on a piece of cloth or waste, the excess stain being removed with a dry rag. The wall board should not be nailed in place until the paint and varnish is thoroughly dry on the cabinet.

Ornamental transfers can be applied as decorations, if desired, one transfer being used on each side and the top.

Above: The main features of this toy cabinet are the colored pigeonholes, which make it easy to put each toy in its proper place.

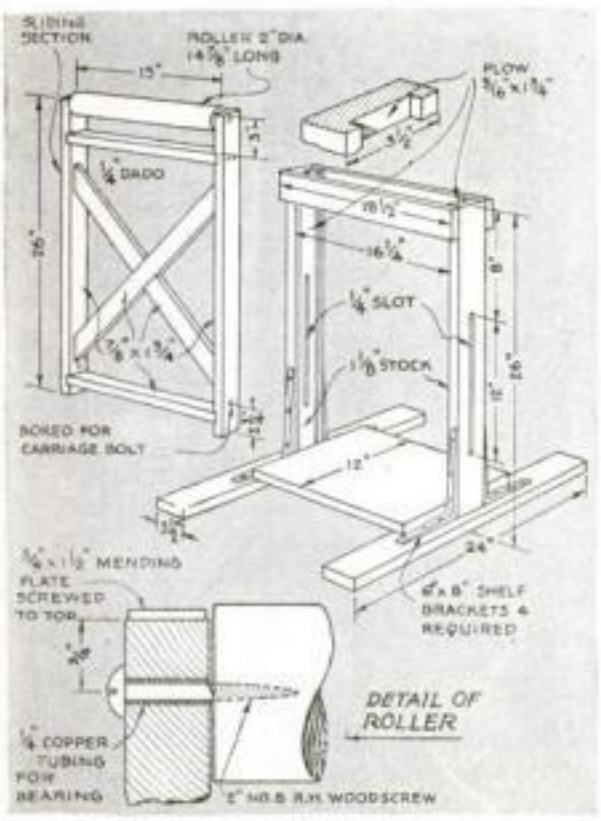
At left: Filled, the cabinet is a real ornament to the playroom.

At right: How it is constructed.



Ripping Boards on a Small Saw

ANY home workshop owner can save money if he buys lumber in reasonably wide boards and rips it to size as needed. Ripping long lumber, however, is extremely awkward on a small circular saw. To overcome this difficulty, therefore, the writer made the roller stand illustrated below and at the right.



This stand is adjustable from 30 to 42 in. and can be used with either saw or jointer.

Build the inside or sliding section first. This is made entirely of ⅞ by 1¾ in. stock. The crosspieces are fastened to the uprights with dado joints ¼ in. deep, reënforced with countersunk 1½-in. No. 10 wood screws and casein glue. A small mending plate is screwed to the top of each upright to prevent splitting. Holes to receive ¼-in. bolts are bored in each side 2¾ in. from the bottom. These holes, as well as the holes for the bearings, which are ¾ in. from the top, must be in the exact center of the uprights. The bearings are pieces of ¼-in. copper tubing.

The roller, which is turned to a diameter of 2 in. and a length of ⅛ in. less than the distance between the bearings, is held with 2-in. No. 8 roundhead blued wood screws.

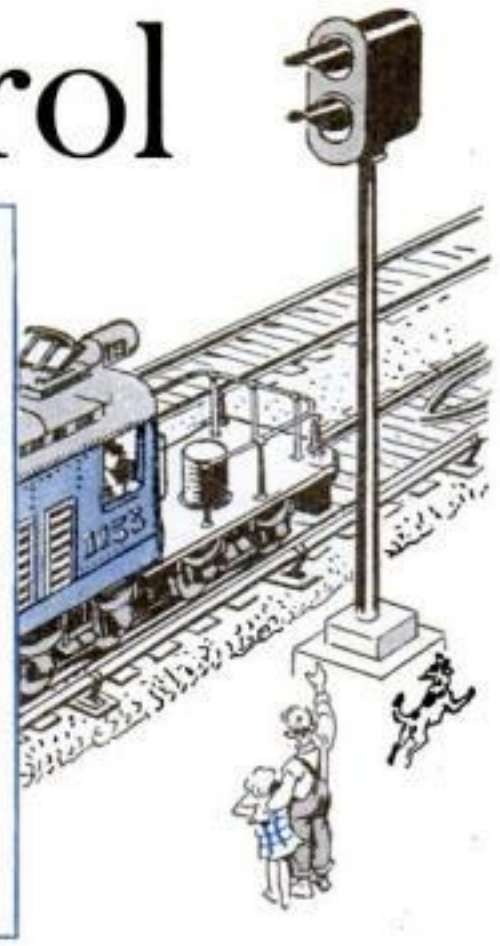
The uprights for the base or stationary frame are of 1⅛-in. stock, 3½ in. wide. They are plowed out on the inside 5/16 in. deep and 1¾ in. wide, and a ¼-in. slot is cut exactly in the center for a distance of 12 in., beginning 8 in. from the top. The upper crosspieces are then secured with 1¼-in. No. 10 screws and casein glue.

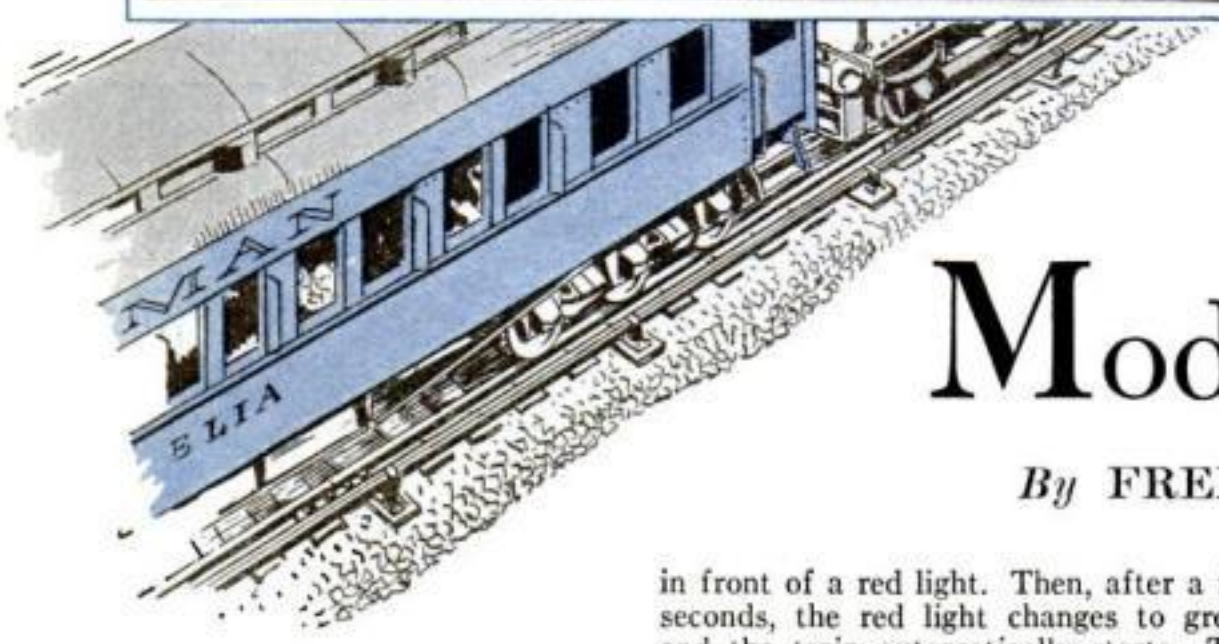
The feet are fastened from underneath with screws and glue and are strengthened with four 6 by 8 in. shelf brackets. A stretcher of ⅞ by 12 in. stock also serves to keep the frame from twisting. Assemble the two frames with two ¼ by 2¼ in. carriage bolts, washers, and wing nuts.

By changing the necessary dimensions to conform, a small rolling pin may be used for the roller.—J. M. CHITTENDEN.

The roller stand, which consists of two frames, one sliding within the other, supports long boards while being sawed.

Full Block Control *for* Your Model Railroad





By FREDERICK D. RYDER, JR.

IMAGINE three or four complete model electric trains all running in the same direction on the same continuous circuit of track with no attention from the operator and yet with no possibility of a rear-end collision. Red lights flash from miniature block signals and locomotives stop in front of them as though a tiny engineer were in each cab to heed the warning. Red lights wink out and green lights flash on, and locomotives start down the track, all without human control. Can you think of anything more realistic?

This is the effect obtained with an automatic interlocking block signal system. Considering how easy it is to construct such a system, it is strange that so few model makers have installed one—probably not ten in the United States.

Of course, an automatic block system of any description is of no use whatever unless you have at least two locomotives. A single train running over track equipped with even the most elaborate block system is not particularly impressive. The green and red lights flash on and off at the proper times, but the train continues without stopping just as though there were no special equipment.

For use on small model railroads having but one locomotive, there is a so-called block signal accessory that halts the train in front of a red light. Then, after a few seconds, the red light changes to green, and the train automatically starts. This procedure, controlled by a thermostatic switch, is repeated at every circuit of the track. Although an interesting and desirable unit, this is not a real block system. It cannot prevent a rear-end collision if two trains are operated on the same track.

GENERALLY all model railroad block signal systems operate on the same basic principle. The current supply to a length of track comprising the block is supplied through a special switch. The normal position of this switch is such that current is supplied to the track of the block section, and an oncoming train therefore runs over the block. At the end of the block, or a short distance beyond that point, the train actuates the switch either mechanically or electrically and thereby cuts off current from the block. A train following stops on a dead track of the first block and waits until the first train has proceeded a predetermined distance beyond this block. At that point the first train actuates the switch to restore the current to the first block, and the following train resumes its journey.

The red light which flashes on when the current is cut off from the block and the green light which burns while the block section is live have nothing to do with the actual operation of the trains; they are added for appearance' sake.

When two or more blocks are interlocked, the system works in the same way except that the contacts operating the special switches are cross-wired in such a way that current is supplied to the preceding block simultaneously with the cutting off of the current from the following block.

There are a number of ways by which the locomotives can be made to operate special contacts. For example, one reader of POPULAR SCIENCE MONTHLY makes use of the weight of the locomotive. He supported the track at the desired points on springs, allowing sufficient motion to close the contact as the weight of the locomotive depressed the track.

Another reader in Milwaukee uses one grounded and one insulated running rail. Electrically, this method has much to recommend it, but the necessity for special track makes it somewhat undesirable.

In the block system to be described in this and two following articles, the special track contacts are made without cutting or changing the standard track in any way. They are easy to build and have the added advantage that they are operated only by the locomotives. Trains will work just as well through the blocks with the locomotive at the rear of the train as at the front. The contact rollers on the passenger cars, which operate the car lights, have no effect on the control switches.

IT IS easy to build a block signal system that will take care of two trains operating on the same track. A single block will suffice if there is not too much difference in the speed of the two trains and the

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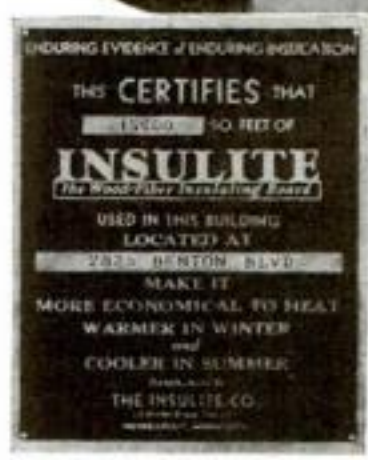

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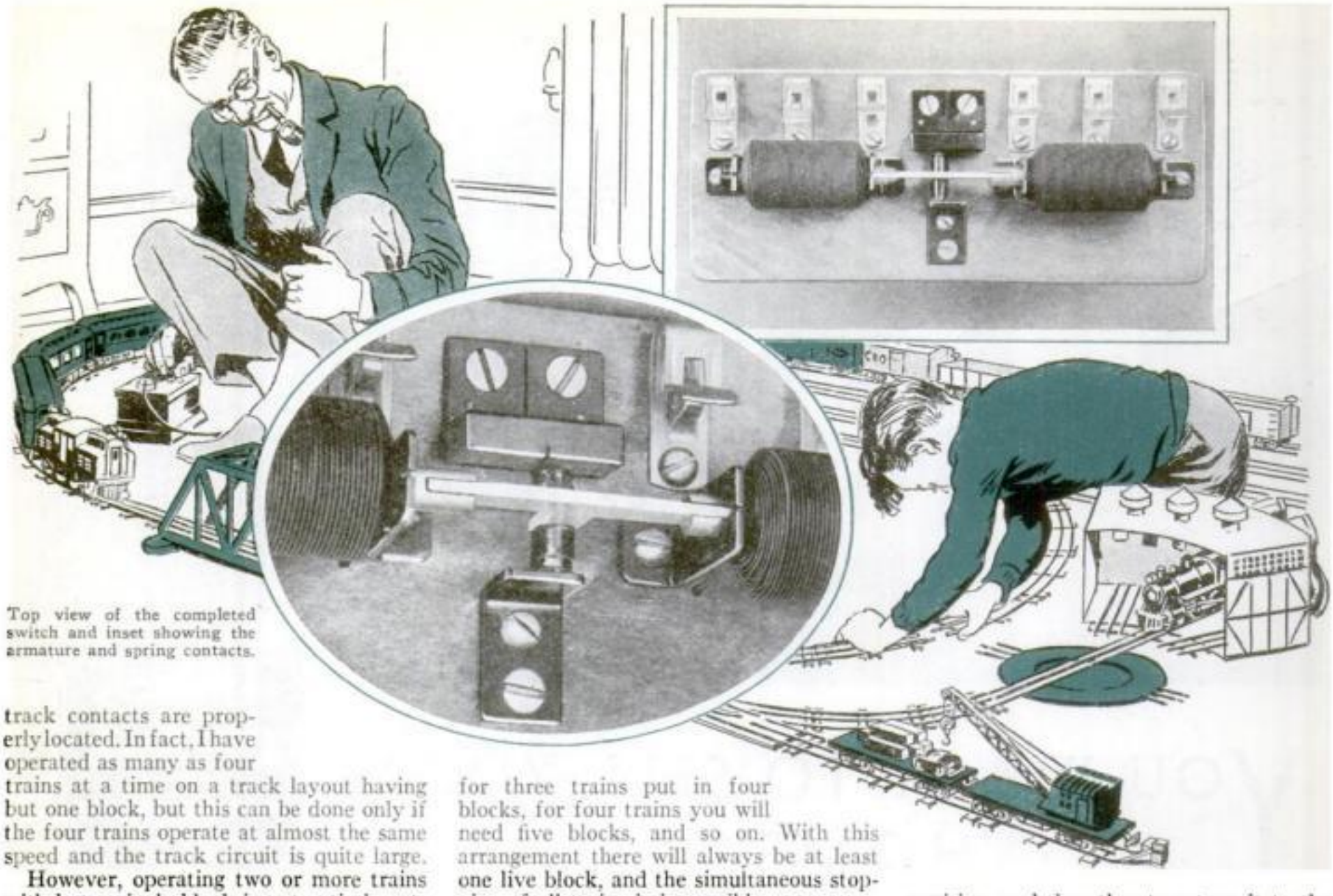


Top view of the completed switch and inset showing the armature and spring contacts.

track contacts are properly located. In fact, I have operated as many as four trains at a time on a track layout having but one block, but this can be done only if the four trains operate at almost the same speed and the track circuit is quite large.

However, operating two or more trains with but a single block is not entirely satisfactory since there is the ever-present danger of a rear-end collision; and if a block signal system does not make rear-end collisions impossible, it is not what it is supposed to be.

If one of a pair of locomotives operating on a track circuit fitted with but one block happens to slow down or stall, you are sure to have a rear-end collision no matter where you locate the track contacts.

TO BE collision-proof, there must always be a block between the two trains, or if more than two trains are running, there must be a block separating each train from the one following it. It is easy to see that to get a block between each train and the trains following, it is necessary to have at least as many blocks as there are trains.

Being anxious to get the block signal system in operation on my own model railroad, I figured it out that far and then proceeded to install four blocks because I intended to operate four trains at a time.

I started four trains from the terminal, one after the other, and what happened? After a few trips around, all four trains happened to run into a block at the same time and there I was with the whole system tied up. That, I found, is what always happens if the number of blocks is the same as the number of trains being operated. The solution, of course, is to have one more block than there are trains. Thus for two trains, install three blocks, for three trains put in four blocks, for four trains you will need five blocks, and so on. With this arrangement there will always be at least one live block, and the simultaneous stopping of all trains is impossible.

It is, of course, entirely practical to operate fewer trains than the limit set by the number of blocks. Two trains, for example, will work perfectly on a track layout having any number of blocks beyond two.

The vital parts of the interlocking block signal system are the special electrically operated switches that control the flow of current.

Each one of these is really only a single-pole, double-throw switch so constructed that it works easily and quickly. In addition to one of these special switches for each block, you will require one special track contact and one special block signal post containing red and green lights. The word "special" is used in each case to indicate that you will have to build the parts yourself. There are no commercially built parts available that will answer the purpose.

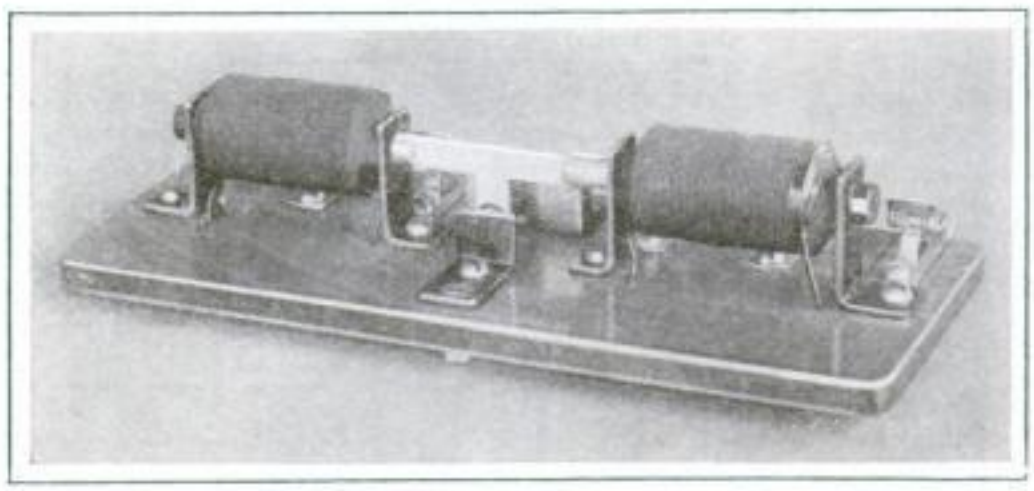
For a single block, used alone, at least two contacts would be required: one to throw the switch to the "off" or block position, and the other to return it to the "on" position. When two or more blocks are installed, each contact serves a double purpose through interlocking.

The only practical limit on the number of blocks you may install, and consequently on the number of special switches, track contacts, and block signal lights you will need, is the length of the circuit of track and the length of the trains you desire to operate.

THE number of track sections in each block must, in any event, be sufficient to stop the train. If the block is too short, a fast running train may coast over it. On the other hand, if the blocks are made too long, a slow train will stop so far from the block signal light that it will spoil the realistic effect.

The special control switches must work on the alternating current supply used to operate the trains. Since the amount of current that will actually flow while the locomotive contact rollers are passing over the special track contact is surprisingly small, the magnets used to throw the switch must be actuated with little current and in a very brief space of time. Furthermore, the switch must remain set in either position without tendency to change through jarring or vibration.

Of the many types of control switches I have built experimentally, the one to be described is the most satisfactory. It never fails to work. Five of them are used to operate the five blocks on my own



How the control switch looks when assembled. The number of these controls that is needed depends on the number of trains to be operated on the one track.

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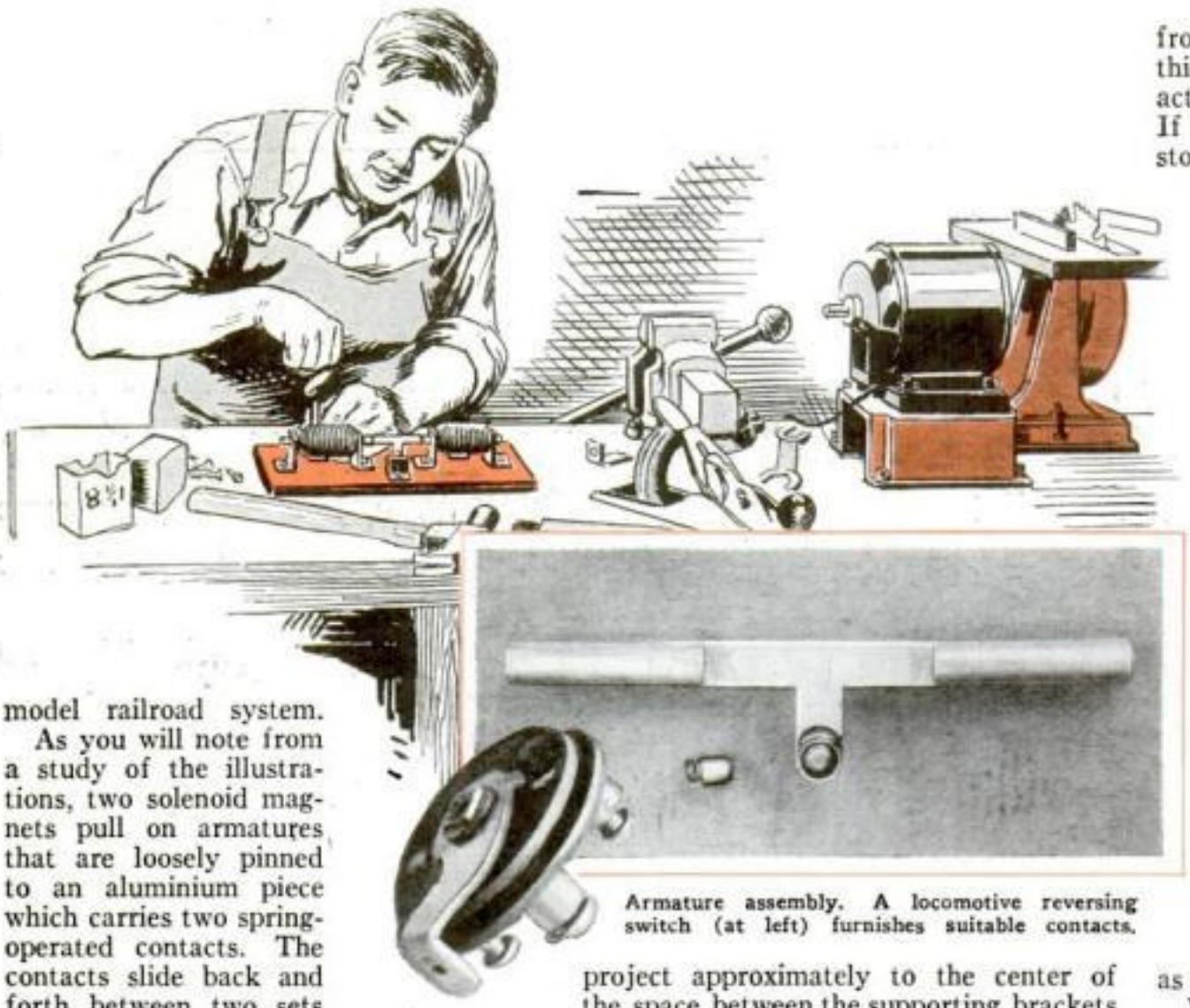


Armature assembly. A locomotive reversing switch (at left) furnishes suitable contacts.

model railroad system.

As you will note from a study of the illustrations, two solenoid magnets pull on armatures that are loosely pinned to an aluminium piece which carries two spring-operated contacts. The contacts slide back and forth between two sets of stationary brass contact brackets, a single one on one side and a double one on the other.

By adjusting the springs back of these plunger contacts to a very light pressure, the movement can be made extremely light and easy. Also, because the contacts are below the center line of the solenoids, the aluminum piece and armatures pinned to it can rotate sufficiently either way to equalize the contact pressure on both sides.

The form on which each solenoid is wound is a piece of ordinary 5/16-in. brass tubing 2 in. long. Tubing of this outside diameter has an inside diameter of ¼ in. Each end of the tube is soldered into a small brass right angle bracket, one screw hole in the angle being enlarged to the outer diameter of the brass tubing. Brass right-angle brackets can be purchased in any hardware store, or they can be bent from brass strip stock measuring 1/16 by ½ in.

ONE end of the tube is placed flush with the bracket, and the other end is allowed to project ⅛ in. Soldering can best be accomplished by clamping the two brackets, with the tubing in the proper position, to a piece of board.

After you have completed the soldering, trim off the excess solder, slit the tube and the brackets from the top with a hack saw, and saw off the bracket feet so that the front bracket *B* and the back bracket *C* (see the drawings at right) will have the dimensions indicated. You will, of course, have to drill new holes in the feet for the screws.

The object of slotting the tube is to prevent the short-circuiting effect of the tubing when used with alternating current. It would not be necessary if the solenoid were to be operated on direct current.

The next job is to fit a ¼-in. drill rod or cold rolled plug 1⅛ in. long inside each solenoid form as indicated at *D*. It should project approximately to the center of the space between the supporting brackets *C* and *B*. Cross-pin it through the end of the brass tube where it projects through bracket *C*. This plug is important, since it greatly increases the magnetic pull.

This finishes the solenoid form, and you are ready to proceed with the winding of the coil.

First, shellac a layer of paper around *A* and then wind on 11 layers of No. 22 double silk covered copper magnet wire. If double cotton covered wire is used, add another layer to make up for the fewer number of turns in each layer due to the thicker insulation. Note that the solenoid coils shown in the illustrations have banked ends. Winding this way eliminates the need for insulating washers at each end. Two coats of shellac on the winding completes the coil.

The switch contact arm *E* is made from a piece of aluminum about 1/10 in. thick. It must be light to insure quick action, and it should be nonmagnetic. If you make it of brass, it should be of stock not over 1/32 in. thick.

The spring contacts *H* and *J* consist of small brass cups fitted with hollow, cup-shaped contact plungers and brass springs. Each brass cup is drilled and tapped for a small screw. A suitable hole is drilled through the lower projection on switch contact arm *E;* then the head is cut from one of the screws, and the two brass cups are screwed on the ends of the screw so as to jam against opposite sides of *E*. These brass cups can be taken from the fiber ring of a standard model locomotive reversing switch. One of these reversing switches contains four of these brass cups fitted with springs and plungers—enough to make up two block switches.

If these reversing switches cannot be obtained, then part *E* should be made of thin brass with short pieces of ¼-in. brass tubing soldered on at *H* and *J*, and ball bearings of suitable size used for contacts.

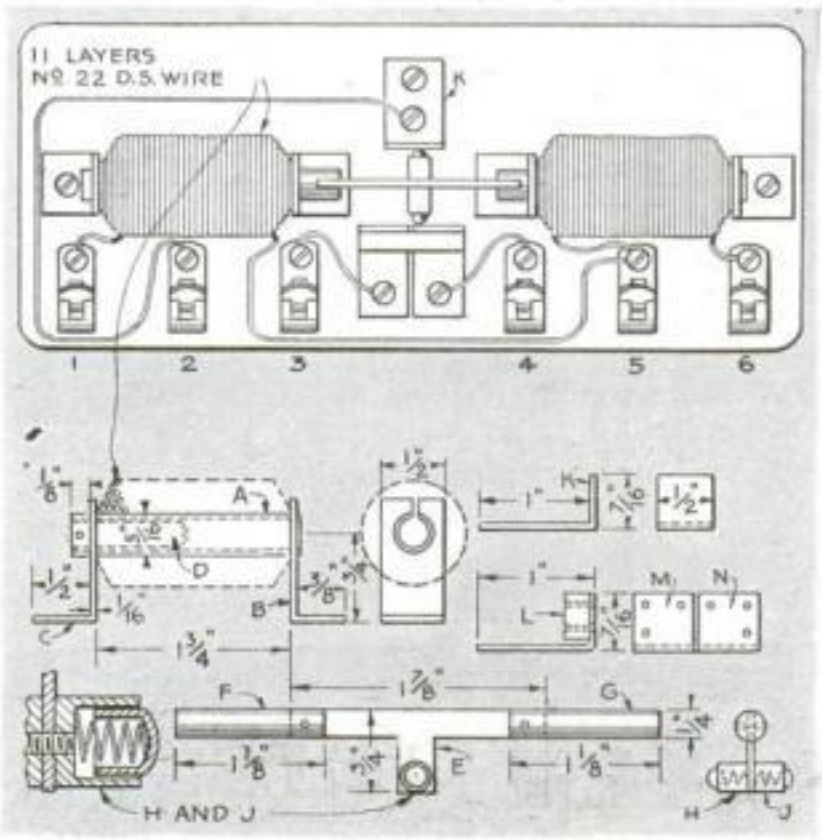
In any case, the springs should be cut off to make the contact as light as possible in order to insure easy motion.

When the contact arm is finished, fit an armature made of ¼-in. drill rod or cold-rolled iron 1⅛ in. long to each end of it. These are parts *F* and *G*. Saw a slot of suitable size in the end of each armature, using two hack saw blades in the frame to make the slot wide enough, and pin the armatures to the ends of the contact arm. These armatures should fit quite loosely on the ends of the contact arm so that any error in lining up the solenoids will not cause binding.

THE stationary contacts *K*, *M*, and *N* are made from right-angle brackets of the same size as those used to support the solenoids. The double contact *M* and *N* is made by taking two of the right angles and riveting them, side by side, to a piece of bakelite or hardwood. Place a piece of thread between the edges of the two brass angles to space them. After the riveting is completed, smooth off the contact faces with a file and trim off the upper portion of the angles above the insulating block.

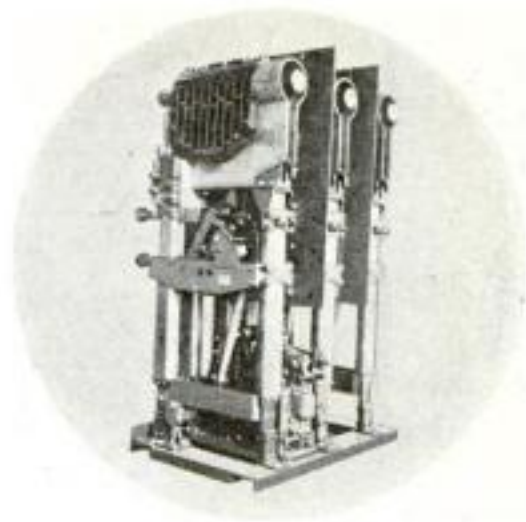
Now cut a base out of plywood or other thin wood 3 by 7 in. and fit six spring clips or binding posts.

Complete the assembly by clamping the contacts and solenoids in place with C-clamps, setting the solenoid magnets as close together as possible and still have the contact slide from *M* to *N*. Locate the screw holes in the base while the parts are clamped, drive the screws, and wire as shown.



Detail drawings of the various parts that go to make up the switch, and assembled view showing how the wire connections are made.

Next month Mr. Ryder will continue with the building of the special block signal lights and the special track contacts.



Whoa, there, YOU IONS...

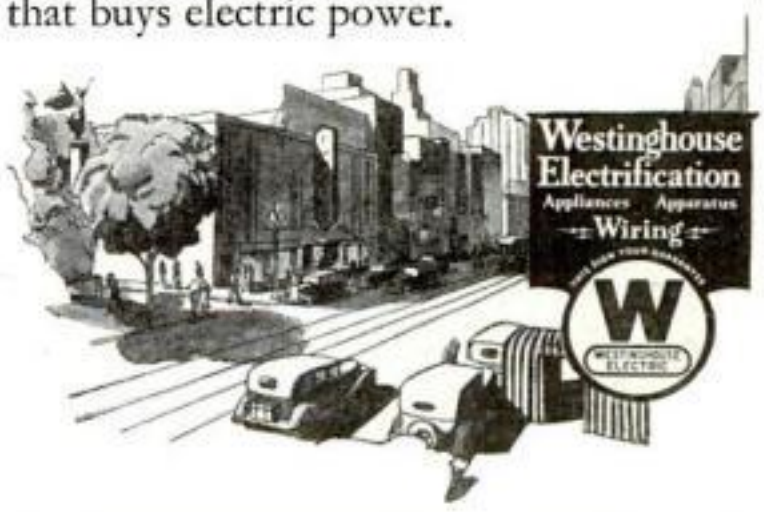
OUT of the mercury arc tube — that odd-shaped bubble of glass with horns at the sides and a pool of quicksilver in the bottom — has come new light on one of the electrical industry's oldest problems.

For years research men had sought to control the arc that flashes between contacts every time a high-power electric circuit is broken. Several methods had been applied with practical results; yet the basic principles of arc formation and control remained unknown.

Then, not long ago, an engineer in the Westinghouse Research Laboratories, while working on applications of the mercury arc tube which demanded accurate arc control, concluded that the impetuous energy of any arc was due to the impetuous ions that compose it. "Harness the ions," he told himself, "and you harness the arc."

So successfully is this principle applied in the new De-ion circuit-breaker that heavy voltages can now be interrupted in open air with scarcely a flash. The electrical industry hails it as revolutionary. Important improvements are effected in a vital class of electrical equipment which the public rarely hears about — yet on which depends that smooth 24-hour-a-day flow of current now taken so much for granted.

Through discoveries and developments such as these Westinghouse research helps to give homes, industry, and transportation more value in exchange for the dollar that buys electric power.



Tune in the Westinghouse Salute over WJZ and the coast-to-coast N. B. C. network, every Tuesday evening.

Westinghouse

Useful Hints for Car Workers

Spark plugs can be cleaned with heat. How to make self-starter safe from children. Screen door spring will increase your heater's efficiency.

POPULAR SCIENCE MONTHLY awards each month a prize of $10, in addition to regular space rates, for the best idea sent in for motorists. This month's prize goes to Charles H. Willey, Concord, N. H., (Figure 3). Contributions are requested from auto mechanics.

Fig. 1. Slowly heating a spark plug until it is red-hot and then letting it cool gradually will remove carbon and won't hurt plug.

BOTH the metal body and the insulator of an auto spark plug are built to stand heat, and this fact can be utilized in a novel cleaning method. Grasp the plug by means of a pair of pliers applied to the metallic portion at the top of the insulator and hold it over the flame of a gas stove, as illustrated in Fig. 1, above.

Apply the heat gently at first so as not to crack the insulator and then, after the plug is well warmed, apply the full force of the flame. Get the plug, or at least that portion of the body and insulator that projects into the engine, red-hot and keep it that way for a few minutes. Then set it aside to cool slowly. You will find that the sticky carbon has been reduced to a flaky deposit that can be brushed off.

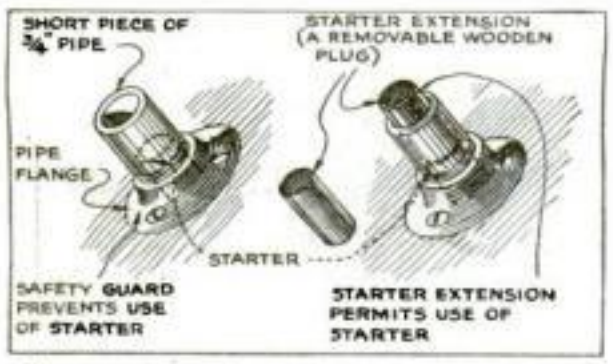


Fig. 2. A pipe flange fitted over starter, with plug to work it, makes car safe for children.

STARTER SAFETY

THERE always is a possibility of a dangerous accident when children are left alone in the car. One of them may press the starter pedal. To avoid this trouble, purchase a pipe flange for a three-quarter-inch pipe and a long three-quarter-inch pipe nipple. Fasten the pipe flange to the floor boards over the self-starter button as illustrated in Fig. 2, then whittle a round wood plug that will fit in the pipe and project above the edge. When you leave the car, take the plug with you and so prevent the self-starter being used.

SIMPLE SCREW HOLDER

THERE are many screws about the auto that are so placed that it is extremely difficult to start them in the hole. The simple tool shown in Fig. 3 will make child's play out of such a job. Take a piece of flat iron or brass strip and bend the ends as shown. Slot one end to the diameter of the largest screw and fit two screw eyes by riveting or soldering.

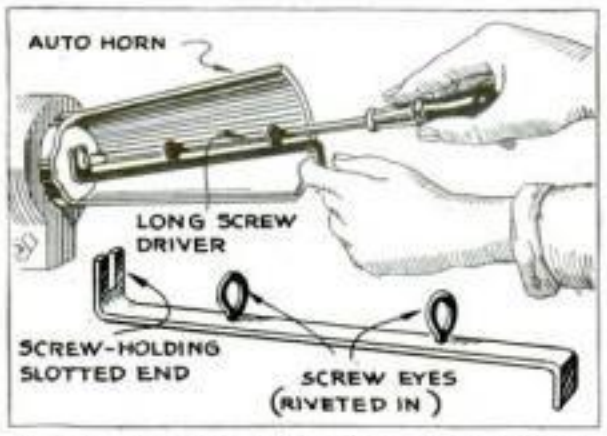


Fig. 3. A slotted piece of flat iron or brass strip serves as a good and simple screw holder.

PIPE BLOW-OUT VALVE

THE easiest way to clean out small piping is to apply air pressure. Unfortunately, the special head on the end of the air pressure hose can only be operated by pressing against the tire valve. Figure 5 shows a way to overcome this difficulty. Take the valve stem from an old tube, file off the flange that rests against the inside of the tube, and so convert it into a tapered end which will fit into the pipe.

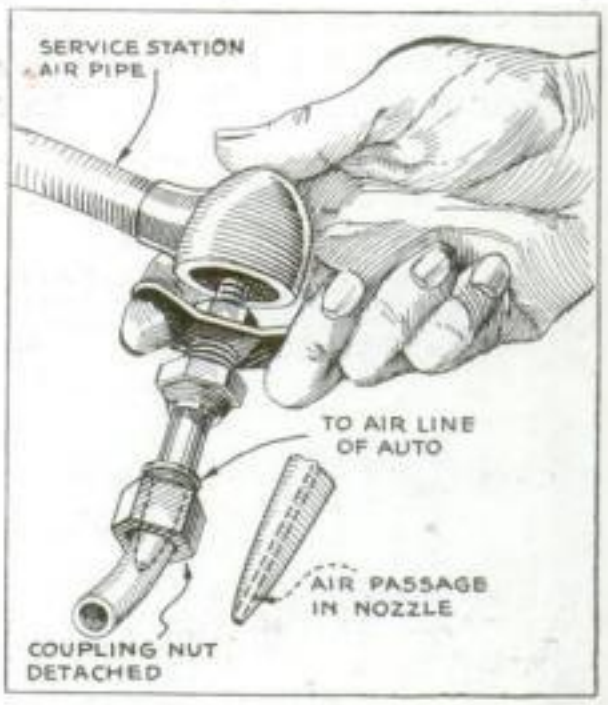


Fig. 5. Valve stem from an old tube, filed down, will fit pipe to be cleaned by air pressure.

USES FOR SPRINGS

FIGURE 4 shows how old screen door springs increase heat radiating surface of a hot air type car heater. Wind the spring around the exhaust pipe as shown. Figure 6 shows screen door springs tightly fastened around the drum of a squeaking brake to muffle the squeak by damping the vibration of the drum.

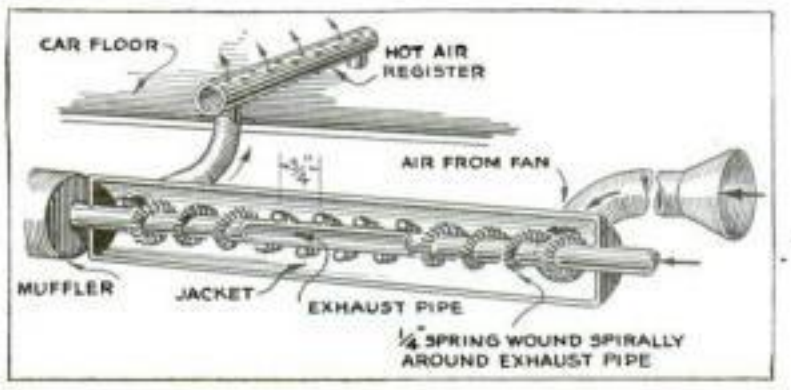


Fig. 4. A spring from an old screen door, wound around exhaust pipe, will increase heat from hot air type heater.

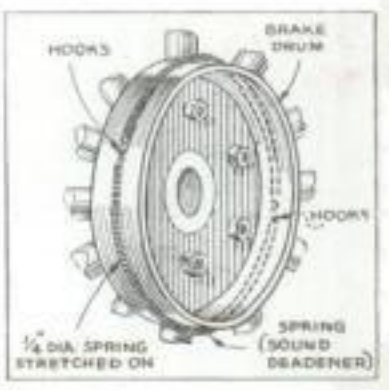


Fig. 6. How squeak in a brake drum can be muffled.

FREEZING WEATHER COMING!

Save your engine from deadly winter wear... change to "double-range" Mobiloil Arctic today!

From below freezing to almost boiling in 5 minutes...

That's why only a *"double-range"* winter oil can protect your engine!

The freezing point—32° F.—is the lubrication danger point for your engine! The heavy summer oil you have been using will lie thick and cold-stiffened in your crankcase. It cannot circulate promptly and reach moving parts. Your battery wears its heart out turning your engine over. The first few moments of "dry" running give your engine more wear than miles of ordinary driving.

If you use an ordinary "winter oil"—you *may* get easy starting. But at hot running temperatures, many of these "winter oils" thin out dangerously, and fail to lubricate.

Mobiloil Arctic will give your engine unique winter protection. It is the *double-range* winter lubricant. Down to zero—and below—you get easy starting and sure circulation. And at hot running temperatures, you get rich, full lubrication.

This *double-range* quality is built into Mobiloil Arctic. Motor oil is made—not found.

Shift gears easily on cold days

Without correct winter lubrication, your gears will tell the same story of winter wear. Cold hardens and separates ordinary greases and leaves gear teeth unprotected.

With Mobiloil "CW" on your gears you'll be delighted at the ease of meshing on coldest days. You can be sure of complete absence of gear wear.

You can get this two-fold protection for your engine and your gears from your nearest Mobiloil dealer. Ask for Mobiloil by name.

VACUUM OIL COMPANY

The Mobiloil Concert is broadcast each Wednesday evening at 8:30, E. S. T., from WEAF and 29 associated N. B. C. stations.

Ask here for Mobiloil

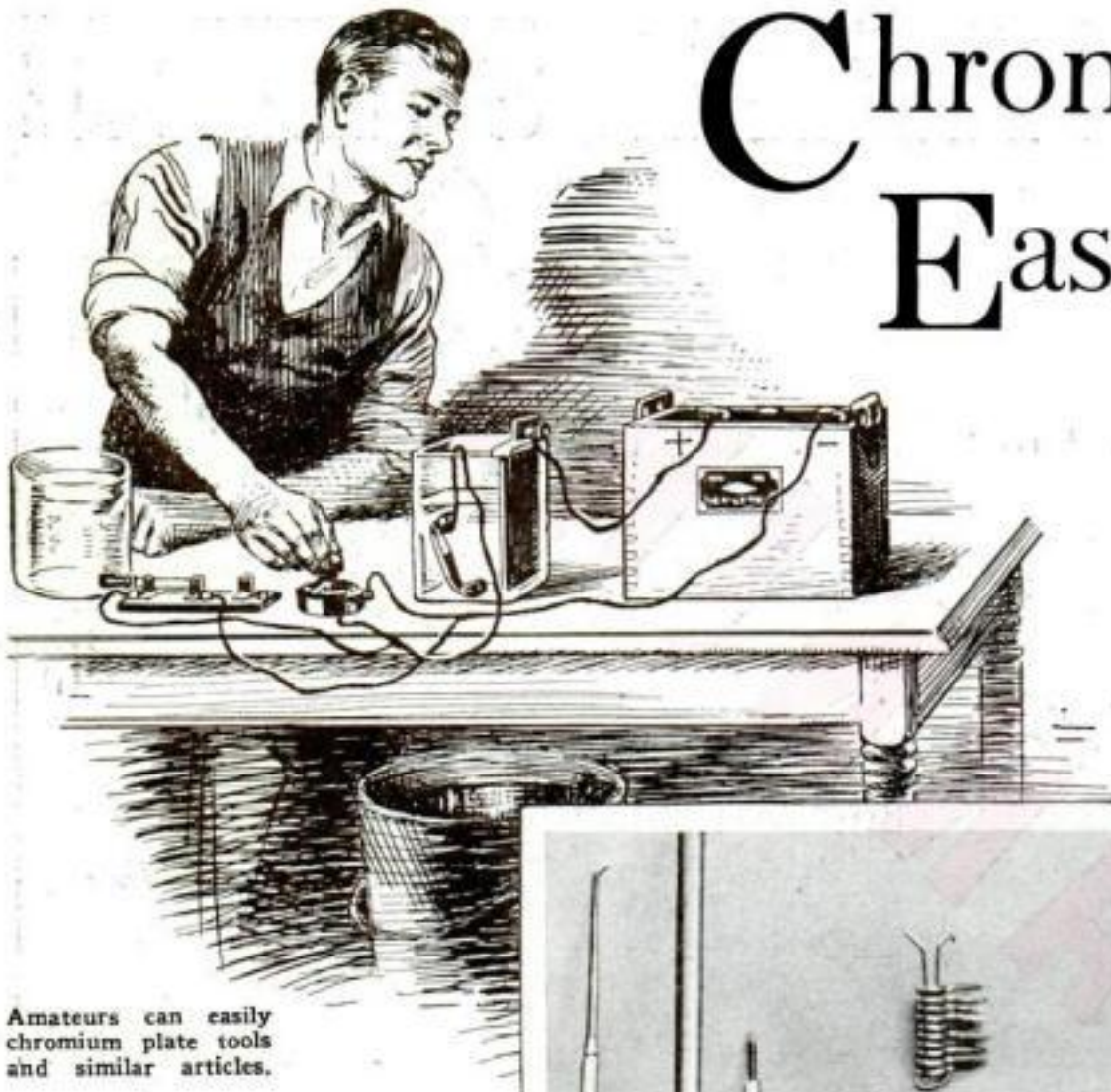
Mobiloil

ARCTIC *for your engine*

"CW" *for your gears*

Chromium Plating Easily Done in a Home Shop

By R. B. WAILES



Amateurs can easily chromium plate tools and similar articles.

CONSIDERING the comparative simplicity by which metallic articles may be chromium plated, copper and nickel plating by the amateur is probably doomed to go the way of the mineral radio detector and the Wimshurst machine for generating static electricity. Chromic acid dissolved in water and a small amount of strong sulphuric acid are the only essentials for preparing the plating bath, and a storage battery may be used as the current source.

The article to be plated is cleaned of rust and grease by the energetic application of emery and a bath in soapy water. After this preliminary cleaning, a wire scratch brush spun by a motor will usually prepare the surface satisfactorily for plating. Of course, the article must be very smooth and perfect if a bright, glossy plated surface is desired. Under exactly the right conditions, a chromium deposit can be obtained that requires little or no rouging and buffing to bring it to a mirror-like brilliancy. Indeed, the beginner will have no difficulty in obtaining good coatings, even if not as bright as he would like, because the current can be loaded into the bath without any danger of depositing "mud" or burning the work.

A good plating solution is composed of 33 oz. of chromic acid (trioxide of chromium or chromic acid anhydride) dissolved in 1 gal. of water with about ⅕ oz. of sulphuric acid added to it. The solution is used at about 130° F. and it should never be allowed to fall below 100° F. or bright deposits will not be produced. One may add chromic acid crystals to the solution from time to time as it becomes weaker. Considerable latitude is possible here since some plating baths contain as much as 55 oz. of the chromic acid crystals to a gallon of water.

In chromium plating, high amperage is required. A current of ten amperes was used by the writer in plating a pair of calipers.

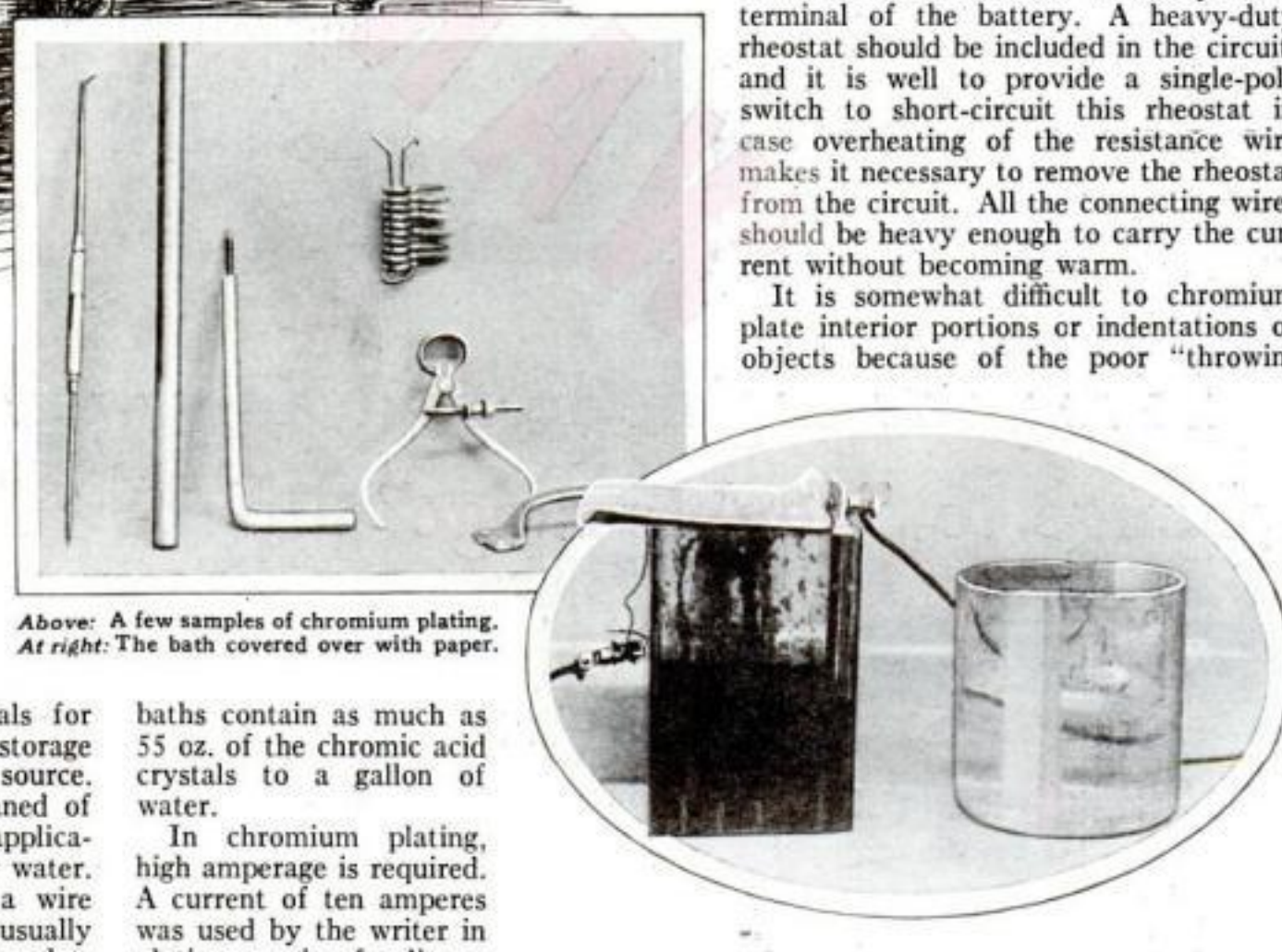
Iron, steel, brass, and copper can be chromium plated directly, provided they are clean. Fasten the article to be plated to a heavy copper wire and connect it to the negative side of the storage battery. A sheet of lead is used as the positive element and is connected to the positive terminal of the battery. A heavy-duty rheostat should be included in the circuit, and it is well to provide a single-pole switch to short-circuit this rheostat in case overheating of the resistance wire makes it necessary to remove the rheostat from the circuit. All the connecting wires should be heavy enough to carry the current without becoming warm.

It is somewhat difficult to chromium plate interior portions or indentations of objects because of the poor "throwing power" of chromic acid solutions. When this problem arises, place the lead plate nearer the indented portion of the object so that it may be completely plated.

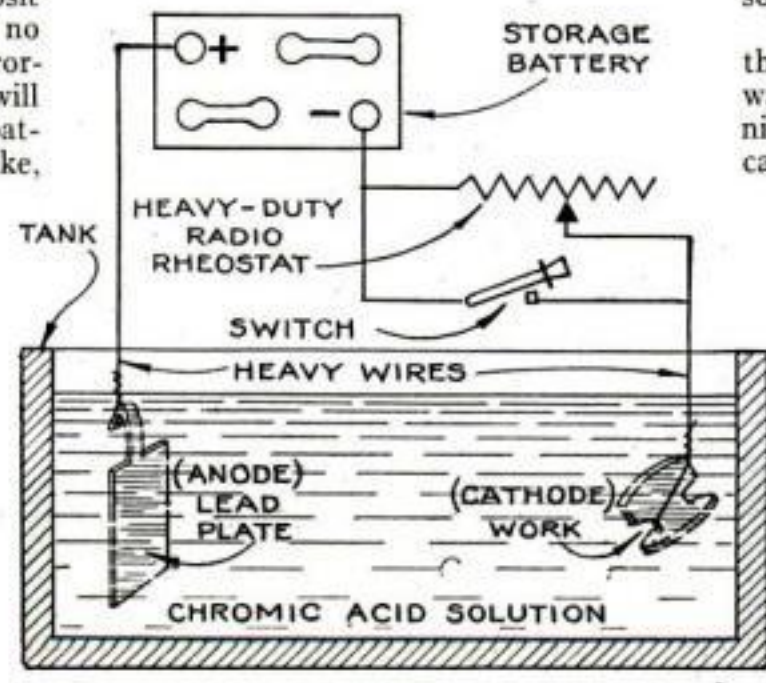
When removed from the plating bath, the articles should be rinsed in a bath of water and then thoroughly washed in running water. Springs, such as those upon calipers, should not be plated while under tension, for they are likely to break.

Pinholes in chromium plated iron objects can be detected by immersing the plated work in a solution of 2 oz. each of strong sulphuric acid and copper sulphate dissolved in a quart of water. The appearance of red specks will indicate the presence of pinholes in the chromium layer.

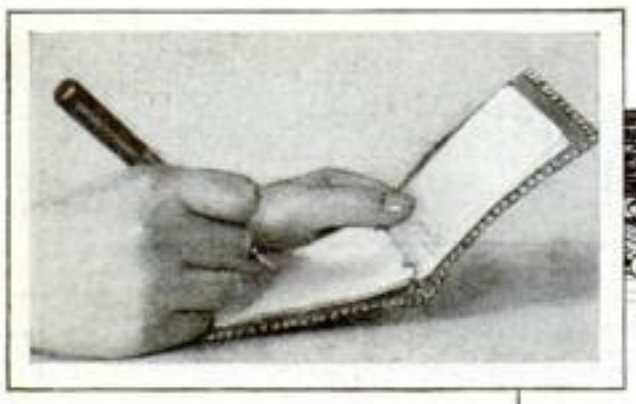
Chromium plating should be performed in a well-ventilated room, as the chromium acid spray evolved is most unpleasant. The amateur plater can lay a wet newspaper on top of the plating bath vessel to overcome this objectionable feature (see illustration above).



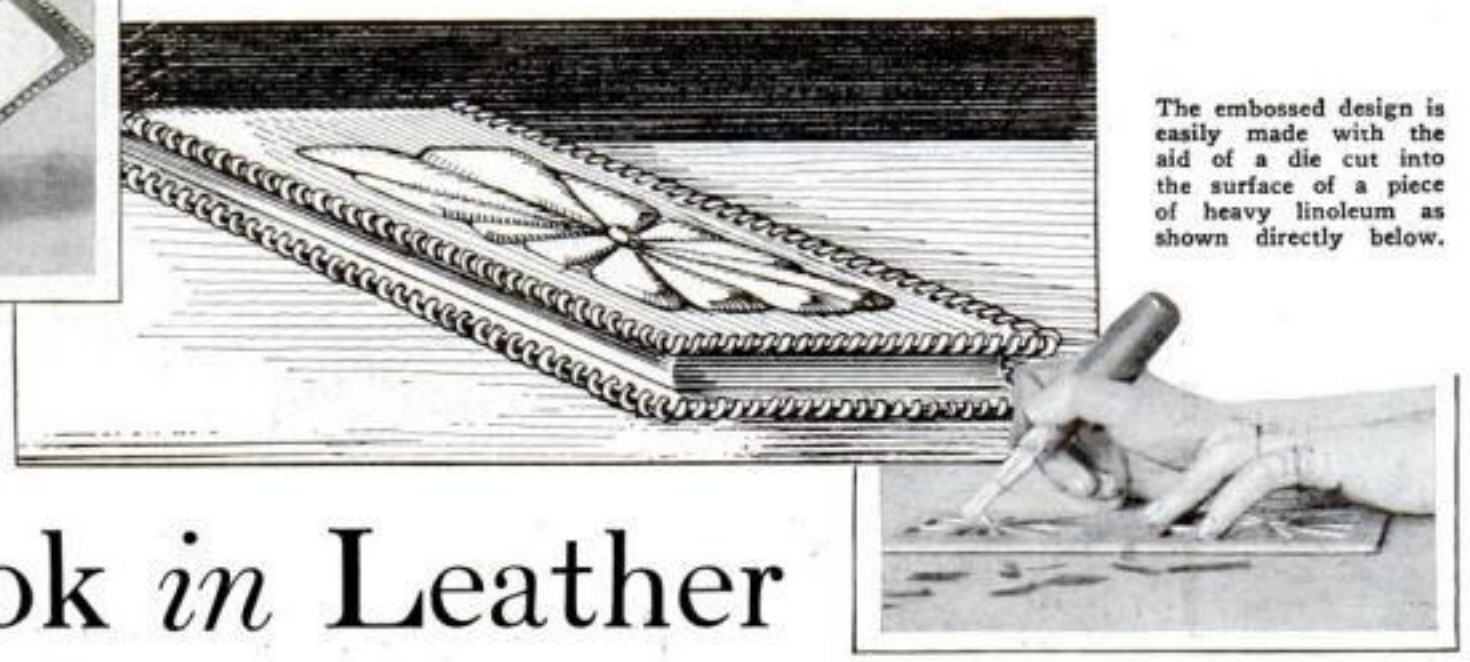
Above: A few samples of chromium plating. *At right:* The bath covered over with paper.



How the battery, rheostat, anode, work, and switch are connected for chromium plating.



With its genuine leather cover and laced edges, this homemade notebook is as decorative as it is useful.



The embossed design is easily made with the aid of a die cut into the surface of a piece of heavy linoleum as shown directly below.

Notebook *in* Leather

How to make a durable, expensive looking cover for a ten-cent filler—A useful Christmas gift

By F. CLARKE HUGHES

WHEN it comes to making Christmas gifts, do not overlook the advantages of leather work. For example, you can buy a cheap little loose-leaf notebook in any five and ten cent store or at a stationer's and with very little labor make a genuine leather cover for it—a fine looking embossed, laced, and lined cover that would cost at least a dollar in a leather goods shop.

Ornamented in this way, the notebook becomes a gift that anyone will prize. Indeed, such a present is usually valued higher and remembered longer than more costly but less useful articles. While you are at it, you may as well make several of the notebooks, because you are sure to want to keep one yourself.

When you have bought a commercial notebook of the size and shape you prefer, remove the filler and metal parts carefully. Then transfer the exact size of the original cover on the leather from which the new cover is to be made. This should be, by preference, brown or black tooling calf, which may be purchased at any first-class leather shop at a reasonable rate. If tooling calf is not available, some other suitable variety can be obtained from any shoemaker. The leather from an old bag or similar article may serve the purpose quite as well as new leather, so first see if there is anything in the attic that will serve.

If the notebook is of the end-opening type, the piece for the cover will be something like that marked No. 1 in the accompanying drawings, but the dimensions, of course, must be the same as those of the original cover.

Decide what design you wish for the surface and mark it on the face of a piece of battleship or other smooth, heavy linoleum. The design may be the one shown or an original one or, if preferred, the initials or monogram of whoever is to use the book. Cut the pattern into the linoleum to form a die. Then wet the leather, place it face down on the die, put pieces of felt on top to form a pad, set the whole between two blocks of wood, and squeeze hard in a vise or any type of press. This will emboss the design clearly on the leather. Once the die is made, any number of covers can be turned out quickly.

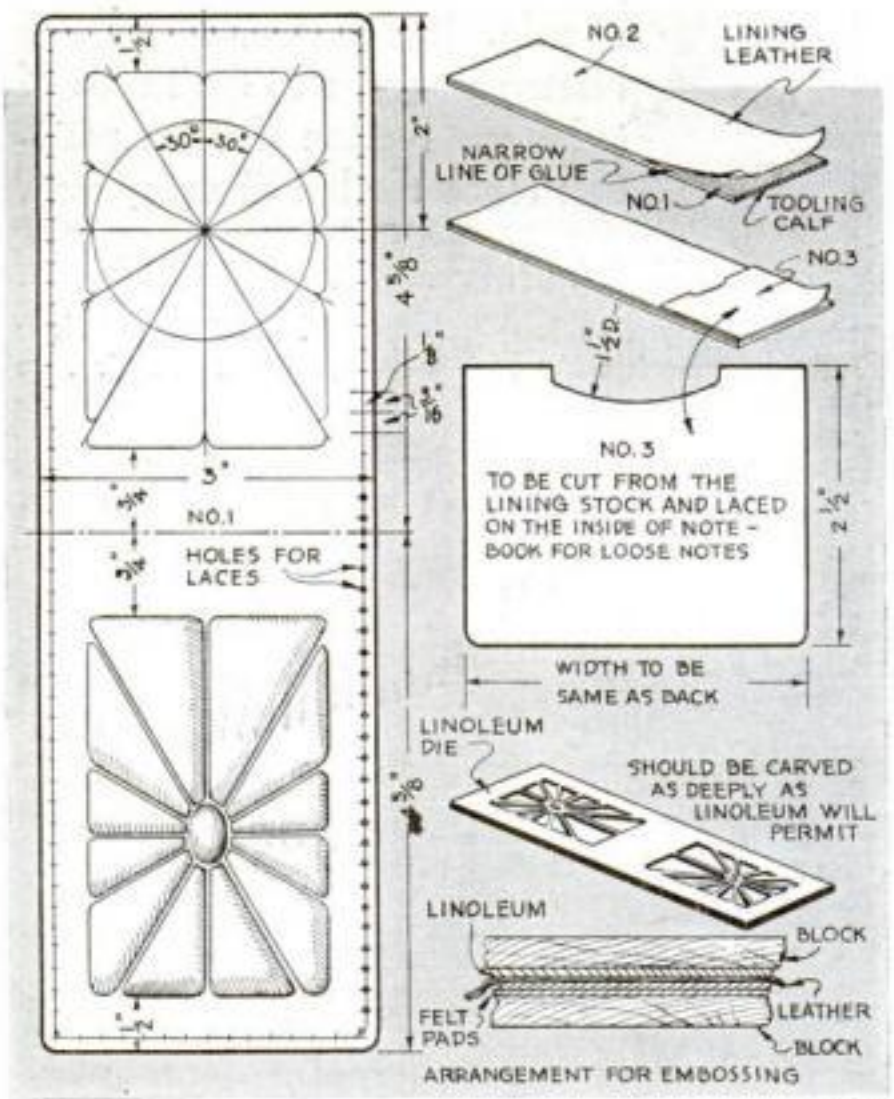
If you wish to line the cover with a piece of kid skin or silk (marked No. 2), cement the edges of the lining to the rough side of No. 1 with rubber cement before punching the holes for the laces. These holes should be about ⅛ in. from the edge and 3/16 in. apart.

Instead of lining the cover, you may make a small pocket (No. 3) from thin leather, or you may do both. Such a pocket is useful for holding loose slips of papers and cards. It is held in place with the edge lacing.

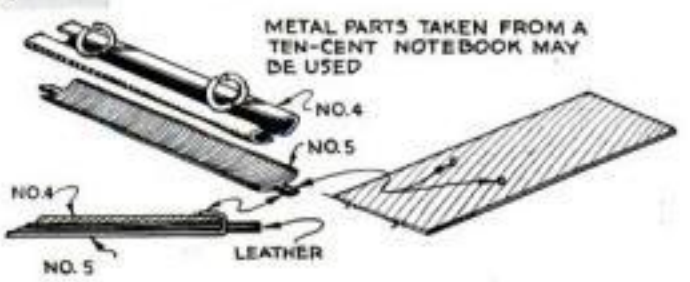
The lace may be cut from any thin leather such as kid or goat, although wallaby or kangaroo is better if it can be obtained. Cut the lace spirally from a round piece of the leather and keep it about ⅛ in. wide. The lacing can be done as shown above, or the more complicated commercial type of lacing may be used, as illustrated in previous articles in this series.

While the lacing adds a finishing touch and is a distinctive feature of much of the finest commercial leather work, it may be omitted, and the cover left plain, without lining or pocket.

The metal parts should not be attached until the cover is finished and the leather has become thoroughly dry. A final polish may be given with ordinary floor wax or shoe dressing.



The cover (piece No. 1) with suggested dimensions, which must be modified, of course, to suit the notebook chosen; and the lining (No. 2), pocket (No. 3), and linoleum die.

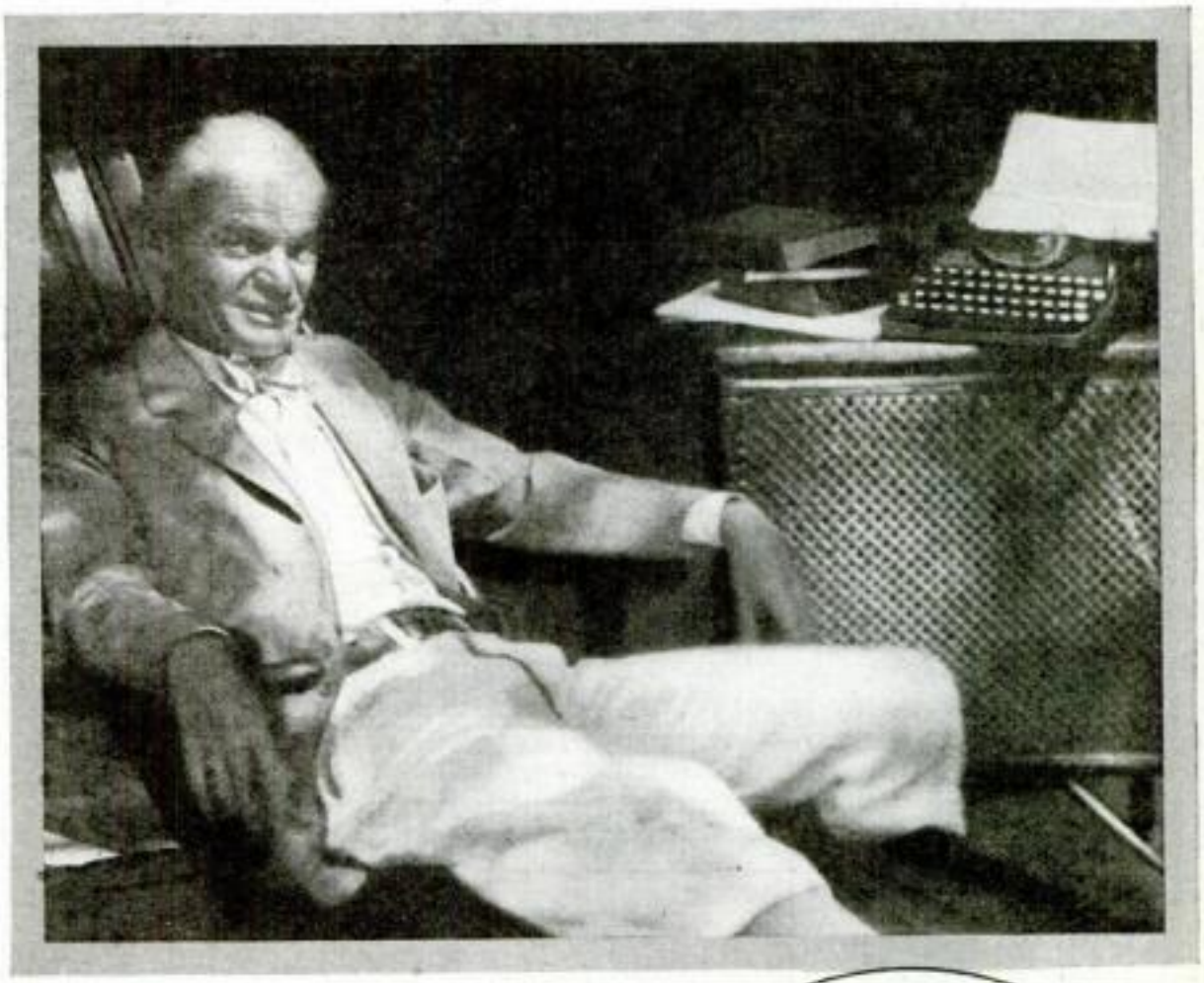


Typical binder parts from a cheap notebook are shown at the right. The prongs on the outside member (No. 5) are passed through the cover and bent over the ends of No. 4.

Give the Portable Typewriter

Used by successful writers for 20 years

Edgar A. Guest writes: "Ever since I began writing verse my Corona has been my constant companion. I have gained a deep affection for it. It is responsive to my every mood and fancy."



Clarence Budington Kelland says: "You'll never get me to sit down in front of any portable typewriter except a Corona. This sturdy machine has seen me through newspaper reporting, magazine editing, and countless short stories." His latest book is "Hard Money."

Famous Girl Columnist: Velva Darling, who writes a daily column for 2,000,000 newspaper readers, has a special rack constructed in her car so that she can use her Corona on the road!

NAME almost any successful writer, and you will also name a user of the Corona typewriter!

Actually an amazing number of well-known writers use this sturdy portable.

The Corona was *made* for them—and for everyone who is not a professional typist. It is not a complicated office machine cut down to other uses. There is literally nothing to go wrong.

If you have never typed in your life, you can operate a Corona almost from the minute you sit down in front of it. In a week you will be typing many times faster than you could write in longhand.

Yet this amazing little machine will do anything a big typewriter will do. It stands firmly on its own feet; it is not fastened forever to the bottom of the case you carry it in. Its frame, cast from a single piece of aluminum, is sturdy and rigid.

For a small down payment you can get one of the latest-model Coronas, in any one of six gay colors, or in black.

The nearest Corona dealer will be glad to lend you a new Corona for a week's free trial. L C SMITH & CORONA TYPEWRITERS INC 1813 New York Life Building, 51 Madison Avenue, New York City.

CORONA SPECIAL, $39.50
(the compact folding typewriter)
CORONA STANDARD, $60.00
(with four-row, single-shift keyboard)
CORONA PROFESSIONAL, $65.00
(with tabulator)

CORONA *Standard Keyboard Single Shift*

By means of a ten-payment plan, you can get this latest-model Corona by making only a small payment down. It is the Corona Standard, with four-row, single-shift keyboard—$60. A delightful gift for anyone on your Christmas list. Ask your dealer to lend you one for a week.

TIPS *for the* Ingenious Shop Man

Using a vise as a punch press—Hand planing soft metal—Two attachments for micrometers

By HENRY SIMON

Micrometer attachment which reads to a ten-thousandth (see Fig. 4).

BY THE ingenious use of familiar tools in new ways, it is possible to save much time and labor in the machine shop. There are almost unlimited possibilities, especially in the small shop, for the individual mechanic to demonstrate his resourcefulness. Many hints on this subject were given in a previous article (P. S. M., Nov. '30, p. 98), and other ideas are suggested in the accompanying drawings.

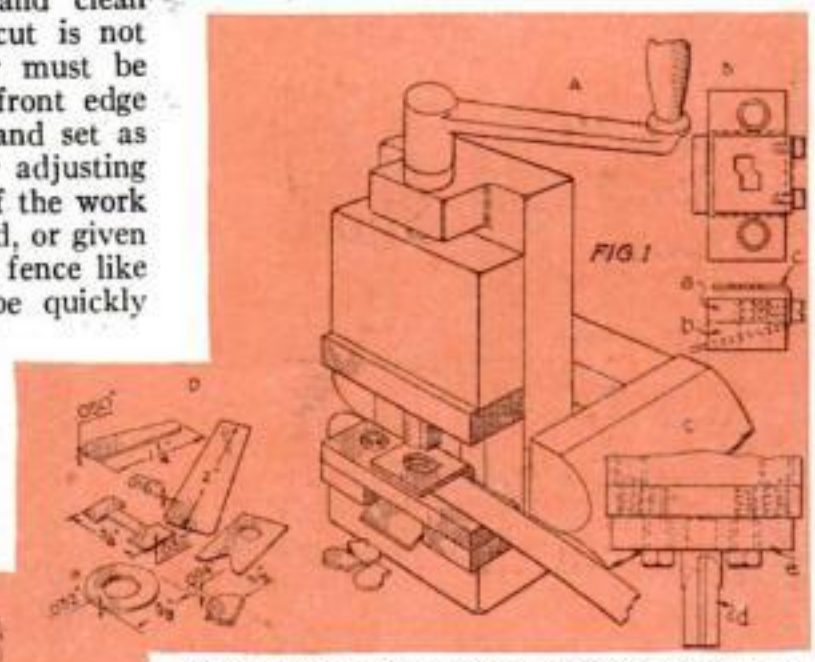
Suppose the shop's only screw press is tied up and there are no other press facilities available. How can a small punch-press job be rushed out to meet the urgent needs of an impatient customer? In such an emergency a heavy milling machine or drill press vise can be fitted up as in Fig. 1 to make an excellent press for small articles.

The regular jaws are replaced, as shown at *A*, by a die "jaw" of tool steel at the solid vise end, and a punch-holder jaw of soft steel on the movable end. A recess is made, as in detail *B*, by supporting the die *a* on two blocks *b*. The stripper *c* is a bent piece of sheet metal attached to the rear edge of the die by screws, and its lower end makes a chute for the punchings. The punch *d* in detail *C* may be set in the movable jaw and the two jaws "floated" into adjustment, or the punch may be attached to a special plate *e* and the plate floated on the jaw. A few suggestions of the work that can be done with such a vise outfit are given at *D*.

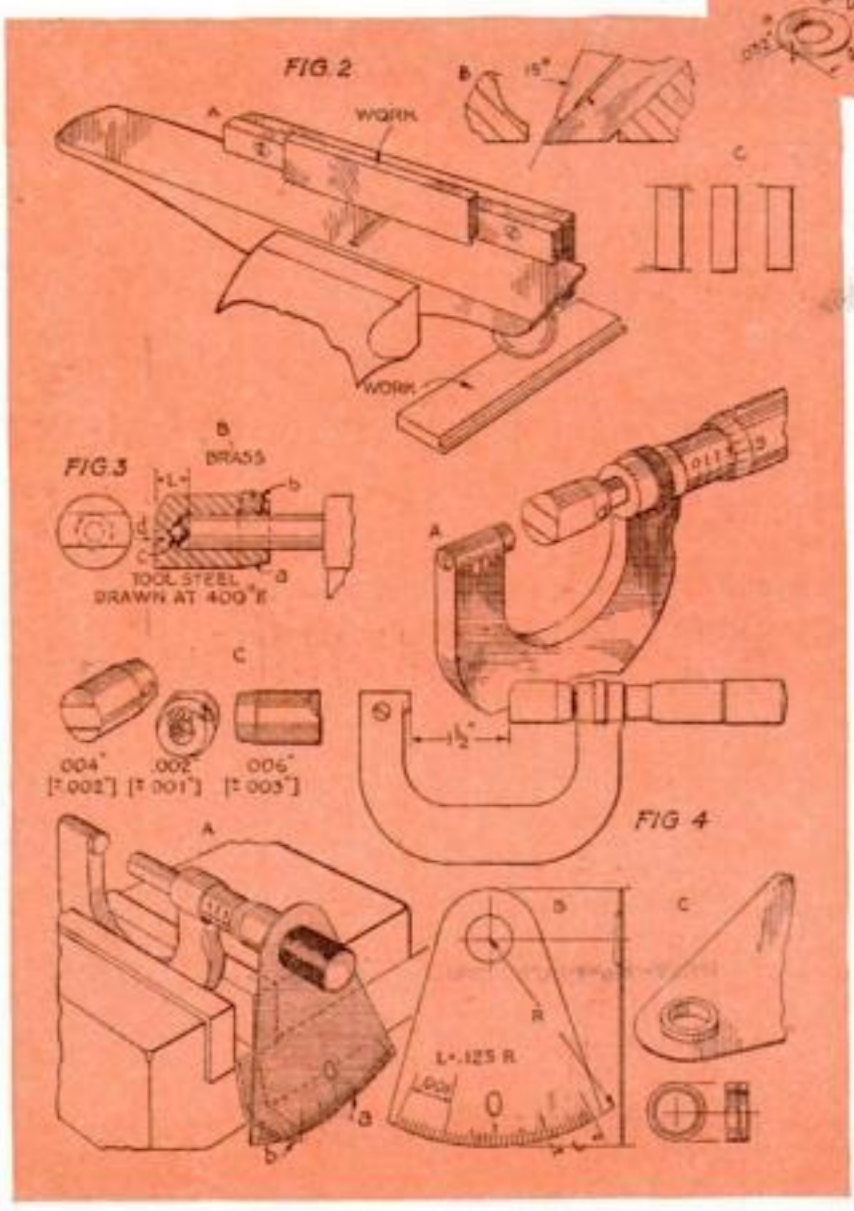
Another unusual makeshift is shown in Fig. 2, where a carpenter's jointer plane, arranged as at *A*, makes an excellent "hand machine" for planing and finishing narrow surfaces on soft metal parts, such as copper and aluminum. In some classes of such work, it does as good a job as a miller or grinder, and at higher speed. Unlike an abrasive belt, it produces a perfectly sharp and clean edge, provided the width of cut is not over, say, ¼ in. The cutter must be carefully sharpened, with the front edge slightly stoned back as at *B*, and set as if for a very fine shaving. By adjusting the cutter sideways, the edge of the work may be either squared, concaved, or given "rake," as illustrated at *C*. A fence like that in the illustration may be quickly rigged up from some pieces of cold-rolled stock.

But to return to the machinist's own tools. If you have ever wished that your "mike" were a "go and no-go" limit gage, look at *A*, Fig. 3. The stepped tip *a*, as shown in detail *B*, is a bit of non-shrinking tool steel that should be a good free fit on the spindle. The most difficult part is grinding the step, although it is not much of a trick with any good surface grinder.

All that is necessary to use the micrometer with this attachment is to set it to the desired dimension, allowing for the difference *L*, which is the distance from the "go" surface to the face of the micrometer spindle, and clamp it by means of the brass screw *b*. The tolerance *d* can be easily changed on the same tip a number of times by regrinding, but the tips are so cheap that it pays to keep several with the usual tolerances on hand, as suggested at *C*.



How a heavy-duty milling machine or drill press vise can be converted into a small punch press.

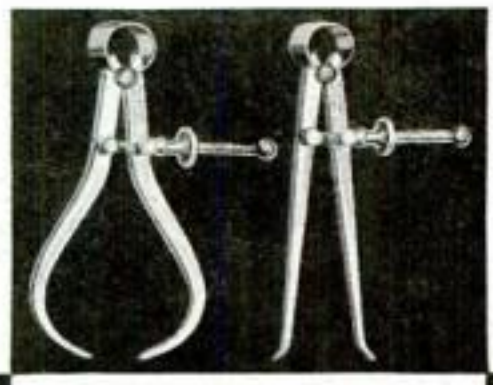


Smoothing soft metal with a carpenter's plane, a "go" and "no-go" gage for micrometers, and a ten-thousandths scale.

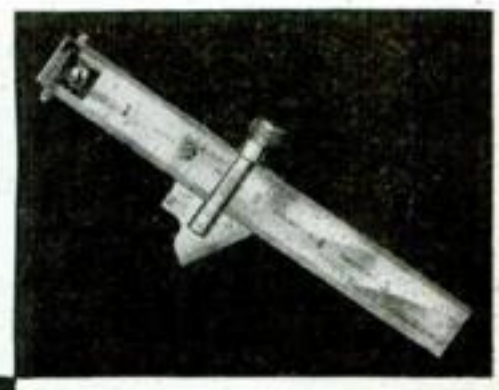
As the same tips can be applied to micrometers of different sizes, such a set will provide a complete range of limit gages that are just the thing for moderately small runs of parts, even though they do require to be handled with the care that one always owes a micrometer.

EVERY mechanic has at some time or other wished that he might read his "mike" directly to ten-thousandths. A quick and reliable, even though makeshift way to do it, is shown at *A*, Fig. 4. The bristol-board sleeve extension *a* is held by friction to the micrometer barrel through the simple expedient of making the hole in the cardboard about 1/32 in. small; it therefore can be set to any angular position relative to the zero mark. The data are given at *B*. The radius *R* is made ten or fifteen times that of the barrel, each ten-thousandths graduation accordingly being as large as, or larger than, a one-

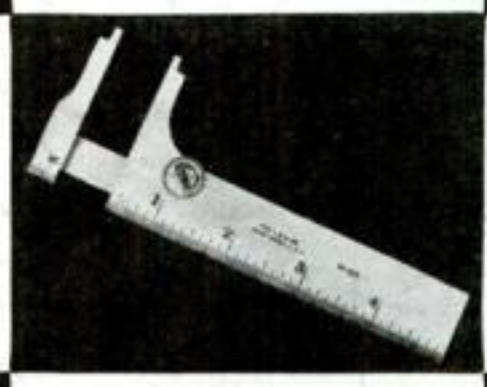
Calipers
Nos. 79 and 73—Yankee type—stiff bow insures accuracy furnished with solid or quick-adjusting spring nut—perfect feel.



Drill Point Gage
No. 22C—combines drill point gage, hook rule, plain rule, depth gage, try square, slide caliper—a handy, accurate tool.

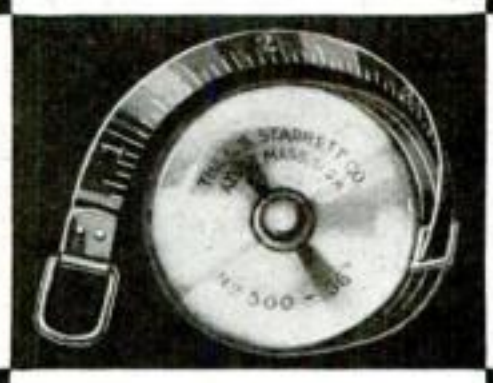


Micrometer
No. 224-AA—four interchangeable anvils—range of 0 to 4 inches by thousandths—decimal equivalents on thimble—black enamel frome.

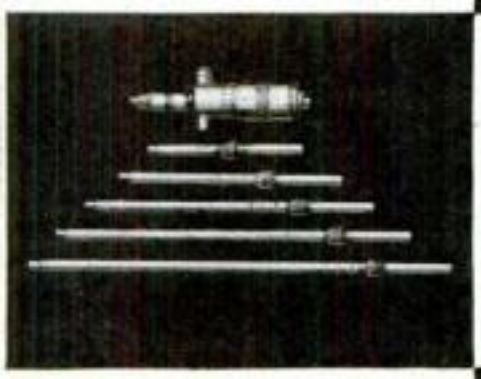


Slide Caliper
No. 425—inside and outside measurements—thumb lock—graduated in 32nds and 64ths—furnished in 3" or 5" sizes—fits pocket.

Pocket Tape
No. 500—furnished in 3, 5, 6, 8, and 10-ft. lengths, graduated in. inches and 16ths—nickel plated case—rounded edges.



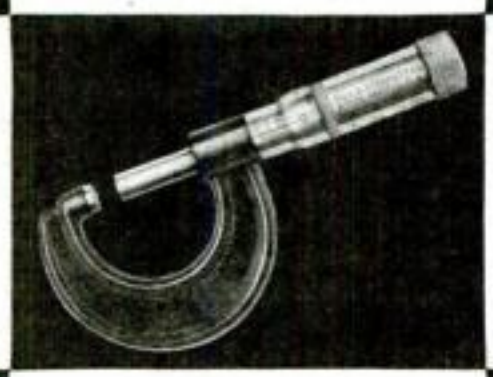
Micrometer
No. 230—cut-away frome—lock nut and ratchet stop—range of 0 to 1 inch in thousandths—finest accuracy and feel.



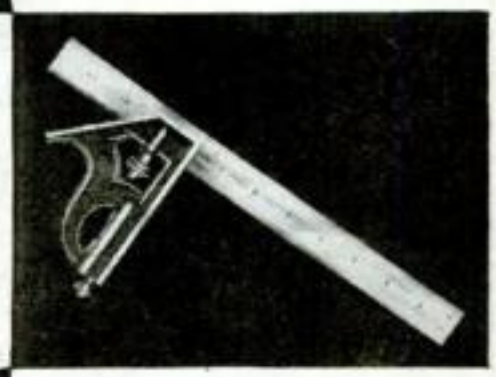
Inside Micrometer
124-A—six interchangeable rods—inside measurements from 2 to 8" by thousandths—lock screw—may be furnished with handle.

Speed Indicator
No. 104—determines r. p. m. of shafting, etc.—frictionless bearing—two extra rubber spindle tips—accurate at any speed.

Micrometer
No. 436—moderate price—black enamel frame—equivalents on thimble—may be furnished with or without lock-nut and ratchet stop.



Combination Square
No. 23—for machinists and carpenters—blade of good hard steel—graduated in 8ths, 16ths, 32nds, and 64ths—eight handy tools in one.



Depth Gage - Hook Rule
No. 236H—combines hook rule, depth gage, caliper, and handy protractor—graduated 32nds and 64ths—inexpensive and handy tool.

Micrometer Depth Gage
No. 440A—three interchangeable rods give range of 0 to 3 inches by 1000ths—with or without ratchet stop—a splendid tool of finest accuracy.

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These fine Starrett Tools are fully described and priced, with many more, in the new Starrett Catalog No. 25"W". This valuable reference book is free. Send the coupon.

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thousandth graduation on the barrel. Once the extension is adjusted, the variation in ten-thousandths can be read directly and without strain from the pointer *b*, which is made from a strip of sheet metal just a "hair" wider than the micrometer frame, so that it can be clamped simultaneously with it.

Detail *C* shows the same appliance made more permanent by the addition of a brass sleeve *c*, which clamps the cardboard segment. This sleeve is made slightly oval so that it will be a good frictional fit on the barrel. Though no micrometer made will measure *absolute lengths* to within less than one ten-thousandth, yet *differences* of half a ten-thousandth can be readily detected with the help of this device.

Old Bill *Talks Shop*

WHEN you take over work another man has started, check the entire job to know where you stand; it will save time.

Tapped holes should be cleaned out before sending a part to be heat-treated or some small bits of steel may become welded in place and later cause the screw to be damaged.

A belt that is slowed down by hand should be cemented, not wire-laced.

Old Bill, foreman of a machine shop.

For highly finished work of the better grade, it is well to equip the parallel clamp with false jaws to prevent marring the surfaces.

To assure a true slot on a milling machine, first indicate the cutter, and then use a fine feed.

A hard wheel, if used for grinding hardened steel, may cause cracks.

See that the teeth of a gear cutter or forming cutter are radial before using it.

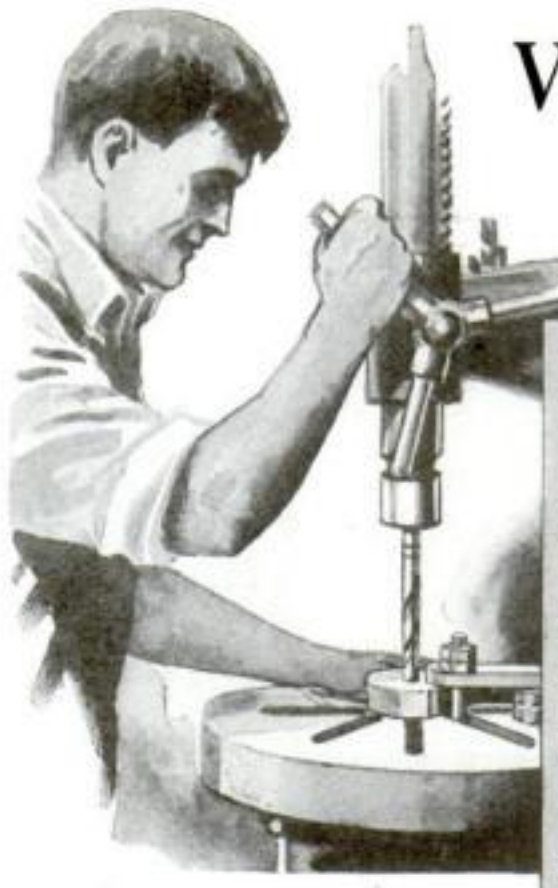
Study your tool catalogues; they have a wealth of useful information.

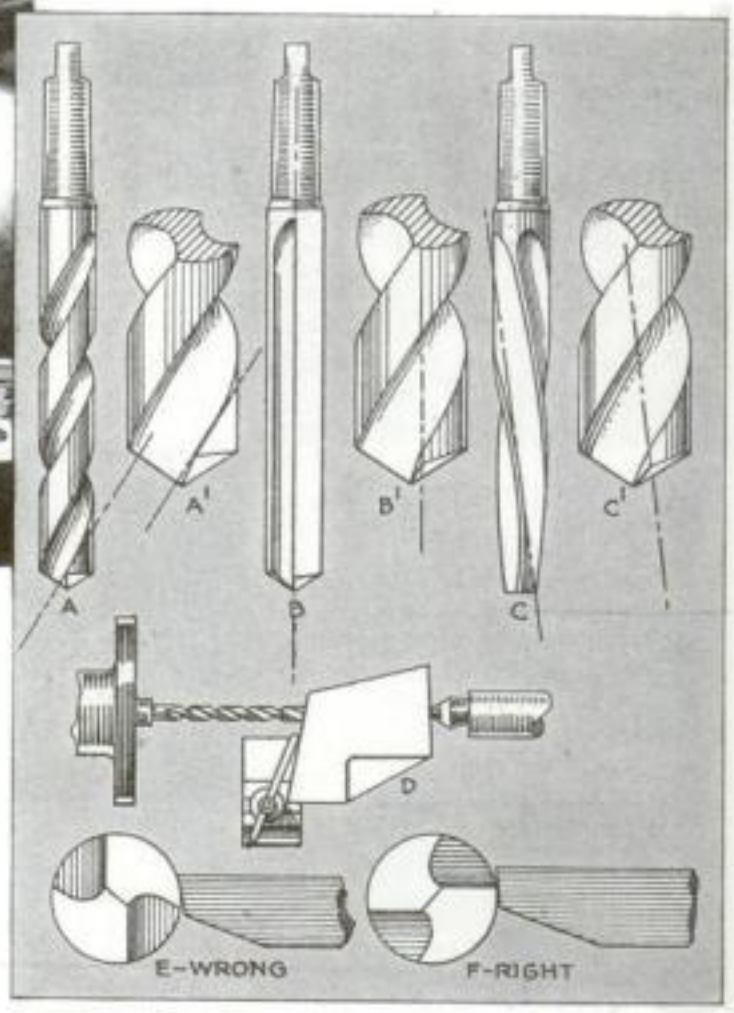
A thin-nosed pair of pliers will often remove a broken tap.

Always consider this: If you were the inspector, would you pass every bit of your own work?

Discarded leather belting makes good false jaws for the bench vise as well as handles for small files.

What to Do When Drills Dig In





Diagrams showing how a twist drill can be modified for special purposes, and two hints on drilling in a lathe

WHEN a twist drill is used to enlarge a hole that is only a little smaller than its own diameter, it often "digs in" and "hangs up," especially if the material is brass. It may be broken and in some cases may even cause personal injuries if the work is held by hand on the press. By changing the shape of the point slightly, however, the drill can be made to feed smoothly under these conditions.

The accompanying diagrams will help to make this important point clear. The screwlike flutes of the twist drill *A* draw the chips out of the hole but also exert a pulling-in force on the drill. At *B* is the straight-fluted drill used on special work such as brass and thin plates. It has no tendency to feed either in or out. At *C* is the twisted reamer. In use it is rotated in the same direction as the drill, but its flutes slant the opposite way and that makes it push back when at work.

These three tools illustrate the effect of the twist. It is this twist that causes the drill to dig in when used as a reamer. There being no metal toward the center to hold it back, the drill "screws in" too fast.

Just a touch on the emery wheel can change the digging-in drill A^1 into one that pushes back, C^1, or to one that does neither, B^1. Grinding 1/16 in. or less from the end up is sufficient unless a very heavy feed is used.

Another way to prevent gouging that is quite effective and sometimes more convenient is to drive a wooden plug into the hole that is to be drilled out a little larger.

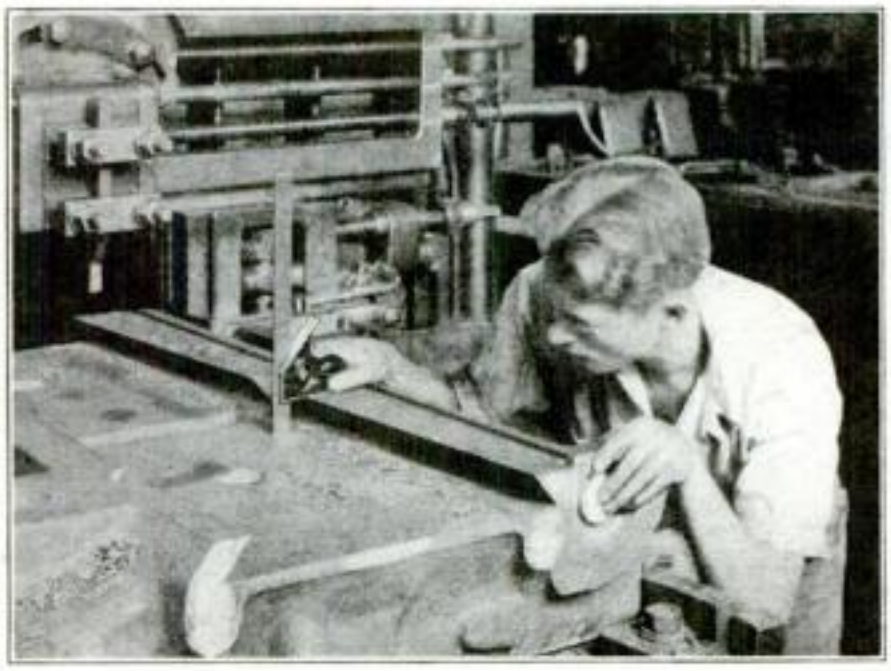
When an attempt is made to drill thin plates, the screwlike flutes cause another difficulty. As the drill goes through, the plate itself is lifted, twisted, and even crumpled up. By grinding the drill as at C^1, a much thinner plate can be drilled on account of the holding-down effect of the forward slanting flute. Because of the springy nature of the material, it is necessary that the flat extend farther up.

If the plates are too thin to be drilled in this way, they can be clamped between two thicker plates, or sometimes two pieces of wood, and a regular drill used.

Where the material is hard, in addition to using the customary slow speed and turpentine, grind the drill as at B^1. The cutting edges will then stand a heavier feed pressure and also dissipate the heat better.

IT IS sometimes difficult to set an odd-shaped piece so that a drilled hole will come out at the right place or, if drilled from each side, so that the holes will meet fairly. This can be nicely done in the lathe. A good center is made where the hole should come out, and this is placed on the dead center. The drill goes in the live spindle. The hole is drilled halfway through, the work reversed, and the other half drilled. The work should be held against the dead center with a lathe tool as at *D;* if not, there is almost certain to be trouble when the holes meet. This precaution should always be taken when the drill is in the live spindle, or bad wrecks may follow.

When a drill in the tailstock is brought up against a piece in the revolving chuck, it does not generally start centrally. The quickest way to center it is to steady it with pressure from the cutting-off tool. This is an old trick, but is often unsuccessful because one point has been overlooked. If the set-up is as at *E,* the drill can wobble in spite of the pressure put on it. The correct arrangement is shown at *F,* where the cutting edge will be held against the "short" side of the hole as it comes around. Then in a few revolutions, as the drill is fed in, the wobbling will stop.—JOHN A. COOK.

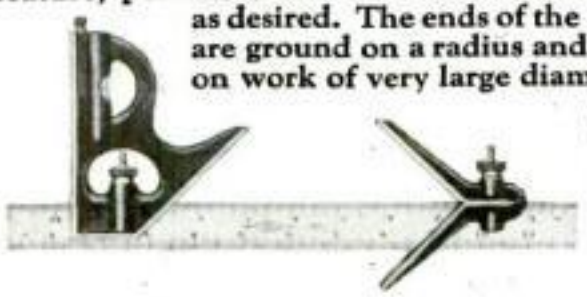


Check your work with Brown & Sharpe Squares

THE RELIABILITY of Brown & Sharpe Squares is universally recognized by skilled mechanics. The variety of work on which they are used and the time they save in accurately checking set-ups and finished work make them indispensable in any mechanic's kit. A few representative types are described here.

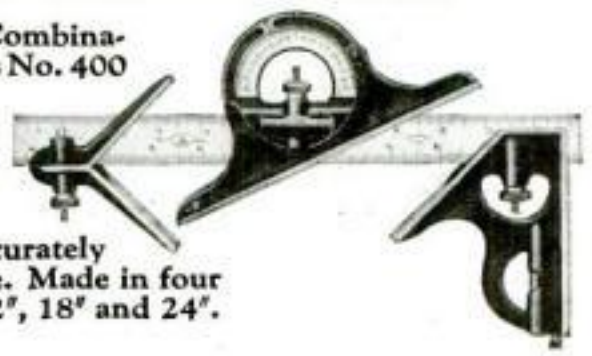
Combination Squares No. 400

The square head, together with the blade, makes an excellent try square, also a depth or height gauge. The reversible bolt (an exclusive Brown & Sharpe feature) permits either side of the blade to be used, as desired. The ends of the centerheads are ground on a radius and can be used on work of very large diameter. Made in five sizes: 6″, 9″, 12″, 18″ and 24″.



Combination Sets No. 438

Similar to Combination Squares No. 400 but have in addition a protractor which permits blade to be set accurately at any angle. Made in four sizes: 9″, 12″, 18″ and 24″.



Height Gauge Attachments Nos. 465A and 465B

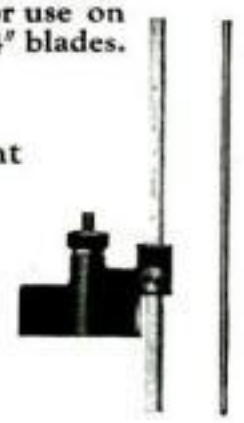
Convert a Brown & Sharpe Combination Square or Set into a height gauge.

No. 465A—for use on Combination Squares and Sets having 9″ blades.

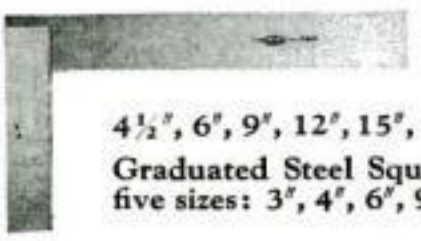
No. 465B — for use on 12″, 18″ and 24″ blades.

Depth Gauge Attachment No. 468

A useful attachment for 9″, 12″, 18″ and 24″ Brown & Sharpe Combination Squares and Sets for converting them into depth gauges



Hardened Cast Steel Try Squares No. 540



Accurate tools which are needed in nearly every shop. Made in eight sizes: 1½″, 3″, 4½″, 6″, 9″, 12″, 15″, and 18″.

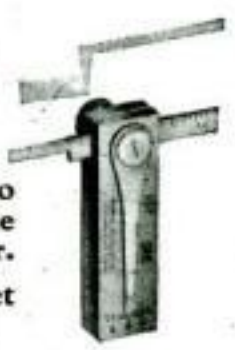
Graduated Steel Square No. 544 is made in five sizes: 3″, 4″, 6″, 9″ and 12″.

Die Makers' Square No. 552

A square with which die clearances are quickly and easily obtained. Also useful to the pattern maker for getting angles and drafts on patterns.

Blade can be set for any angle up to 8 degrees either side of zero. Angle of blade is indicated by the pointer.

Furnished with straight and offset blades. Length of blades 2¼″.



Adjustable Square No. 554

Particularly useful to toolmakers for small work. Blade may be adjusted to any length and can be used where it would be impossible to use a fixed blade. Blades are reversible.

Wide blade is 2½″ long, graduated on one side — one edge in 32nds, the other in 64ths.

B·S

These squares are among the 2300 useful tools described in our Small Tool Catalog No. 31. Ask your dealer for a copy or send to us for one. Dept P. S., Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

Brown & Sharpe Tools

"WORLD'S STANDARD OF ACCURACY"

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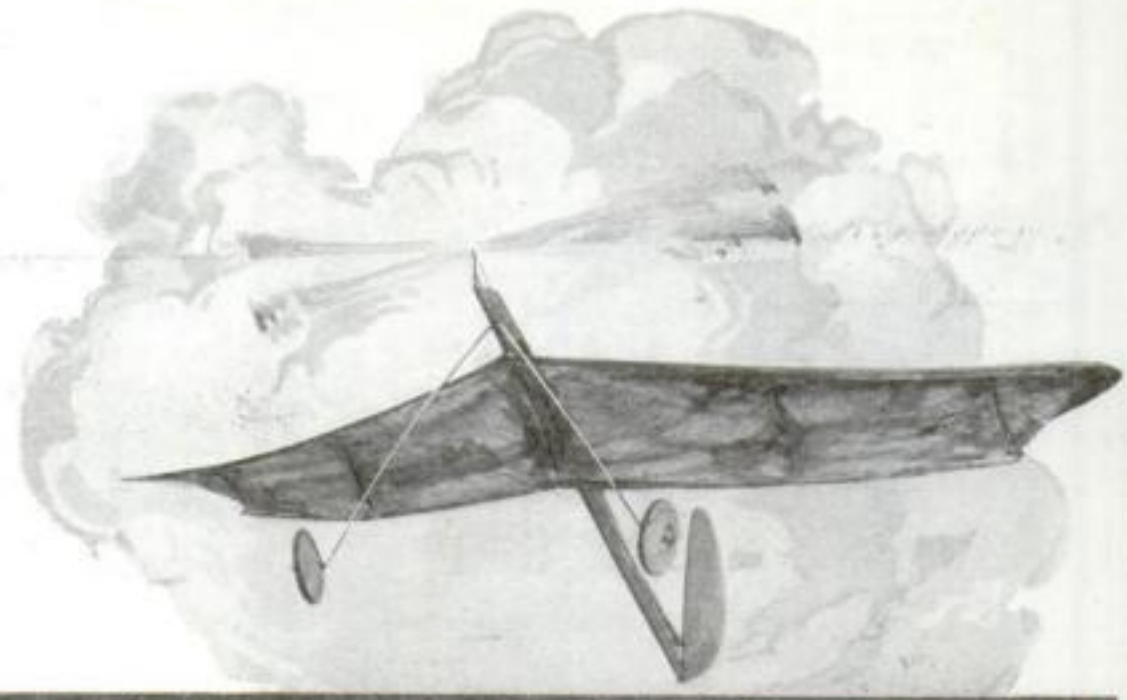


Tailless Model Plane

By Edwin T. Hamilton

The tiny plane, an ideal model for indoors, may be launched by hand or from the ground.

ALL experienced model airplane builders enjoy attempting the construction of new types of aircraft. Such experiments open new fields of thought and often produce ideas of great value.

It is with this in mind that the writer presents what may be called a "tailless" model airplane—not to show the reader how it can be done as much as to prove that it is possible, and in the hope that the model enthusiast will experiment with it in an effort to develop this type of model. While the writer believes this to be the first "tailless" model to appear in a magazine, it may be, of course, that others have been designed, built, and flown successfully.

Simplicity is the main advantage of the model illustrated, as it is a single-stick tractor without the usual elevator, the lack of which is corrected through the specially designed wing.

The correct position of this wing is found by the usual trial gliding method.

MOTOR STICK. This consists of a balsa stick 1/16 by 1/8 by 8 in. long. Its rear end is left square, while the front or nose of the stick has a 1/8-in. bevel, as shown. A lightweight propeller bearing is fastened with an ambroid type cement on the 1/16-in. top edge of the stick at its front end, while a rear hook is attached in the same way to the rear end. If the builder wishes to make his own fittings, he can do so by bending them from No. 8 music wire.

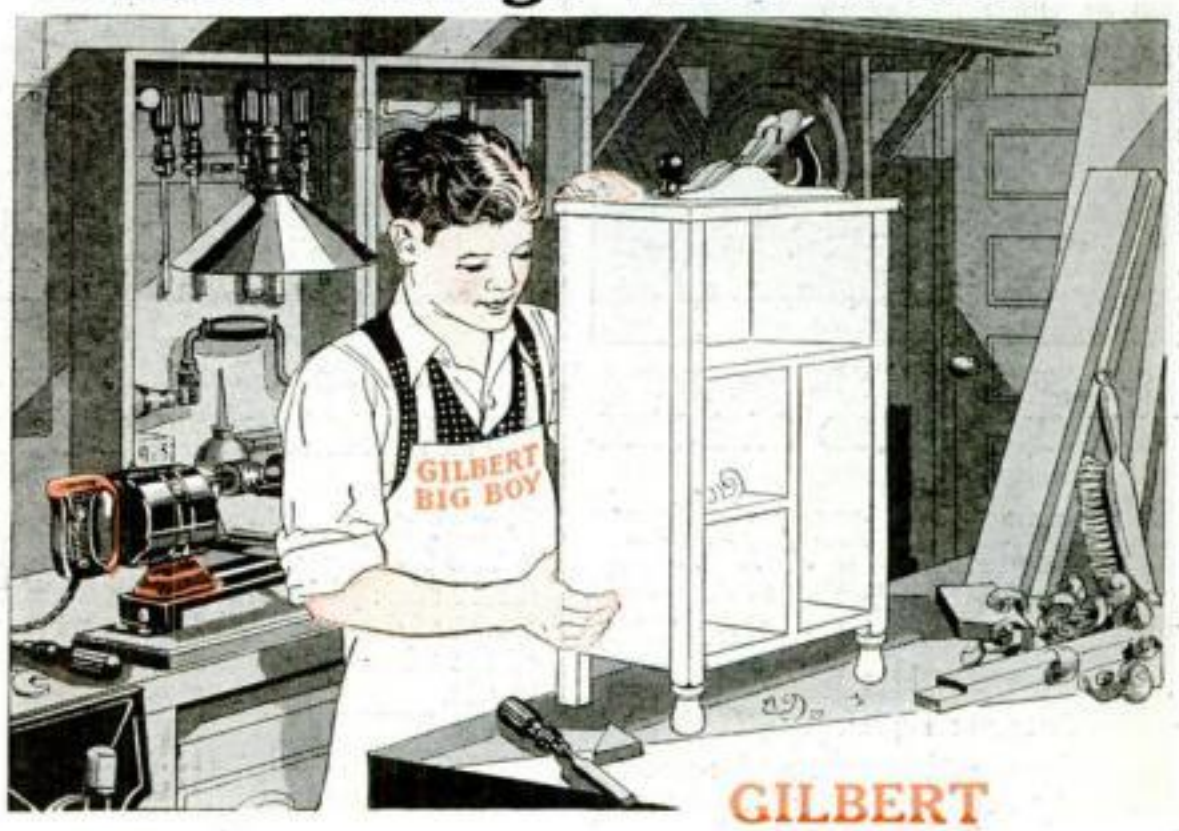
RUDDER. One piece of 1/32-in. split bamboo forms the edge of the rudder. This is bent to proper shape by heating the bamboo strip over a candle, bending as desired, and holding it in position until cool. The ends are cemented together. Cover the structure with Japanese tissue paper on one side only, holding it in position with dope.

LANDING GEAR. The supporting struts of the landing gear are made from a single length of No. 8 music wire, bent with small-nose pliers. In making the 1/4-in. diameter wheels, strips of split bamboo are bent to form 3/4-in. diameter circles, and their ends are cemented together. Cut four pieces of writing paper in the form of 7/8-in. circles and pierce the center of each with a pin. With scissors, cut radially from the edge of each piece to the pinhole.

Short, narrow paper strips are now wrapped around each wire axle loosely enough to form rolls which will spin freely on the wire. The rolls are secured with glue and removed from the axles. Place two of the round disks on each roll and lap the scissors cut until the diameter of the paper is equal to the diameter of the split bamboo circle, which automatically gives the desired shape to the sides of the wheel. Cement the sides to the bamboo circle, which will then form the tread of the wheel. Trim the ends of the paper roll to match the paper sides, and replace on the axle. Each axle is bent back at its end

Hello boys!

Now YOU CAN BUILD Those Things You Want



$10— This big red brass-bound chest 26 items, and 2 instruction books. It's 18 pounds of useful scientific tools. A Saw, A Plane, A Brace and Bit, Chisels, and dozens of other he-man tools for the boy builder.

Boys!

Your own furniture for your own room! A boat you can row yourself! A bird house! A house for your dog! A thousand other things you've always wanted.

You don't have to ask for them any more. You can build them all yourself and give Mother and Dad the surprise of their lives.

All you need is my Big Boy Tool Chest. Just lift the lid, put on the sporty carpenter's apron, call in your pals and show them how a real builder goes to work. My Boy Builder's Plan Book shows exactly how each thing is made. There's a tool for every purpose. I know what you need and I've built these tools for real service.

Look over my Big Boy Tool Chests and the New Electric Lathe (now reduced to $19.50) at any good store. Tell Dad you want to branch out and be a builder right away. You can start right in making Christmas presents for the whole family.

A. C. Gilbert

The New Electric Lathe

Portable type for home or commercial use. Practical, efficient. Powered by Polar Cub Universal 110 volt motor, A.C. or D.C. Mounted on 30 in. bed complete with tail stock, two centers, slide rest, wrench, ¼ in. drill bit, turning tool, ¼ in. arbor to receive attachments and fitted with three jaw chuck, key operated. Chuck takes round shank drills up to and including ¼ in. diameter. Pistol grip handle, toggle switch. Motor easily detached from lathe for use as portable drill. Lathe turns wood up to 7 in. diameter and 18 in. long. Grinding, polishing, sanding, buffing attachments supplied separately. Size, 34 x 9 x 5-½ in. Packed individually, corrugated container.

25 lbs. ..... **Price $19.50**

FREE—

We have a few extra copies of the Big Plan Book for the Boy Builder. You can have one if you get this coupon to us in time. Fill it out and rush it into the mail today. A complete Big Boy Tool Chest catalog comes with it. Don't delay.

GILBERT "Big Boy" Tool Chests

Boy's Size

No. 701—For the Little Fellow—Contains 11 pieces with Plan Book.....**Price $1.00**

No. 701E—Dandy Set for the Beginner. Contains 12 pieces with Plan Book...**Price $2.50**

No. 702—Practical Young Carpenter's Set. 16 pieces with Plan Book.....**Price $2.50**

No. 707—Handy Practical Set for Boys. 19 pieces including Plan Book.....**Price $3.50**

No. 765—Feature Set in Boy's Size Group. Dandy set, 24 pieces. Real tools for practical service. Packed in big red chest with Plan Book.....**Price $5.00**

Dad's Size

No. 780—Household Treasure Chest. 26 pieces of real he-man tools including big 16 in. Cross-cut saw, 15 in. Steel level and 7-¾" Block Plane. A regular outfit. Two Plan Books. Packed in brass-bound chest....**Price $10.00**

No. 785—Handy Carpenter's Set. Practical selected, high grade tools. 33 pieces, two plan books, 15 in. Steel level, 16 in. Cross-cut and Dandy Keyhole saw, also 10 in. bench plane. Packed in brass-bound chest....**Price $15.00**

No. 790—Feature Set of "Big Boy" Line. 35 pieces including 10 in. Plane, Ratchet Brace, 15 in. Level, 20 in. Cross, 18 in. Rip, and Dandy Keyhole saws. Two plan books. Every needed tool for master builders. Packed in big red chest, brass-bound corners and lock.....**Price $25.00**

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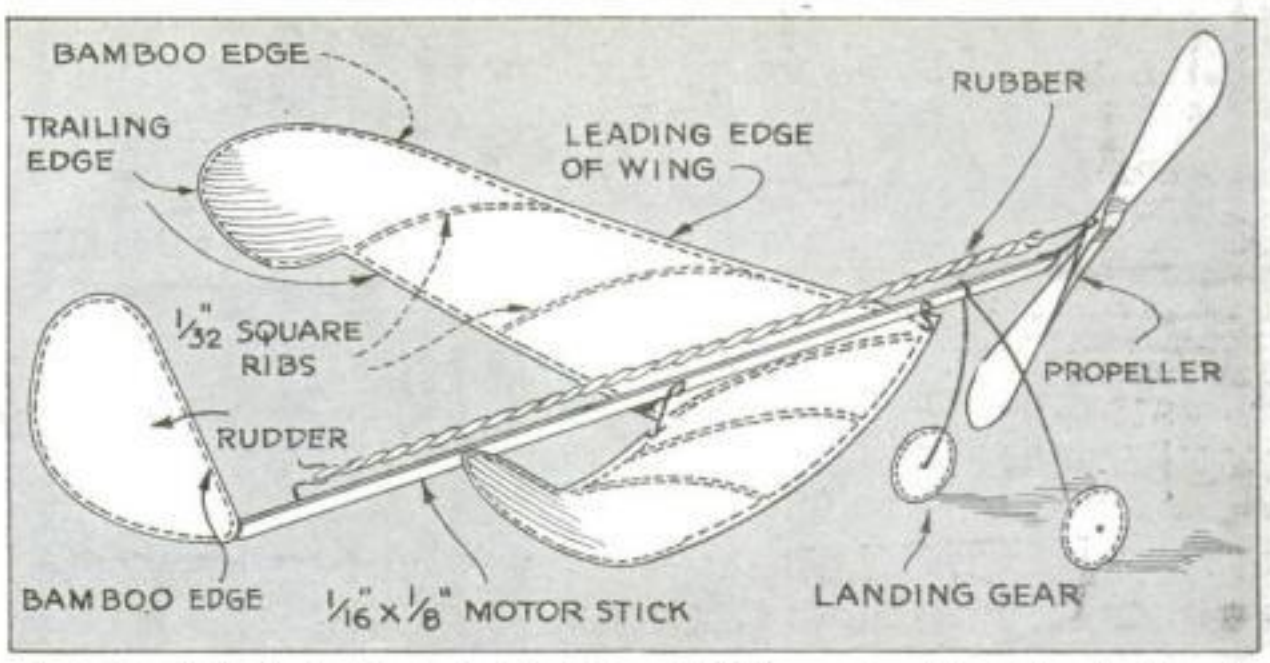


Perspective sketch showing the construction of the model. The correct position of the wing is found by the usual trial and error method of gliding, a position giving a short, steep glide being the best.

so that the landing wheels will stay on.

The landing gear is cemented to the motor stick ¾ in. from the nose. Finally, a coat of dope is applied to the paper sides of the wheels, as well as to their bamboo treads.

PROPELLER. The propeller is carved from a ½ by ¾ by 6 in. balsa propeller blank in the usual manner. A propeller shaft of No. 8 music wire is bent to shape as shown and inserted through the center of the propeller hub. It should then be bent over, and a drop of cement applied to hold the shaft in place. Two copper washers should be applied to the shaft before it is inserted through the propeller bearing.

MOTOR. The motive power is a piece of 3/16-in. flat rubber, which should be long enough to allow a slack of ½ in. between the propeller shaft and the rear hook. The two ends of the rubber are held by piercing the ends with the hooks.

WING. The leading edge of each wing half is constructed from a 1/32 by ⅛ by 6 in. balsa strip, while the trailing edge is 1/32 by ⅛ by 5 in. long. The five ribs are of 1/32 in. square balsa wood and are given a slight chamber (see illustrations).

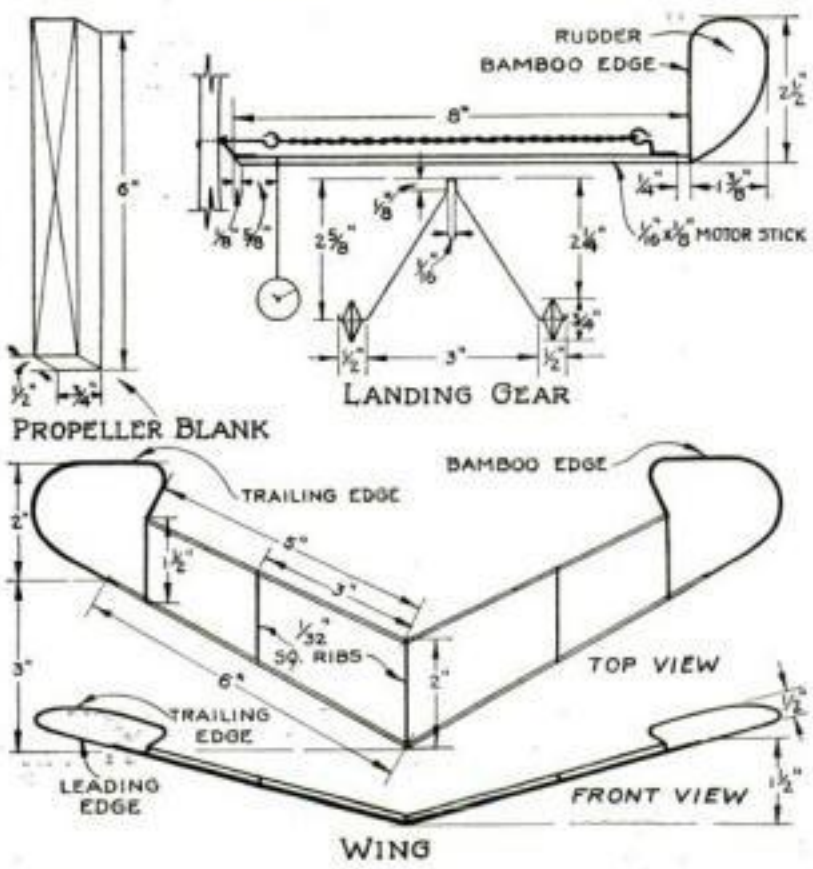
Draw a full size working layout of one half of the wing exactly as given in the plans. Bend a length of 1/32-in. split bamboo over a flame to the form shown for the tip. This half of the wing is now assembled on the layout by placing each part on it in its proper position. Cement the ribs and tip to the balsa spars. When attaching the tip, see that the bamboo length, which is attached to the trailing spar, is at right angles to it. At this point, construct the other half of the wing by following the same directions and using the same layout.

The sweepback of the wing is gained through the difference in length of the leading and trailing edges, so that when the two halves of the wing are cemented together, they should give the desired shape. The wing has a 1½-in. dihedral angle. Lay one of the halves flat on a smooth surface and cement its two main spars to the two main spars of the other half while this second half has its tip raised off the table so that the end of its leading spar is 3 in. above the surface. This will give each half of the wing the necessary 1½-in. dihedral angle.

Cut out a pattern of the wing from Japanese tissue, allowing about ¼ in. surplus material around all sides in order that the paper can be wrapped over the edges of the wing structure. Cover the wing on one side only—the top—and hold with dope. The wing is now ready to have its tips turned up. This can be done easily by heating the bamboo, but do not allow the flame to burn the paper.

The usual large and small wing clips are now applied. The large clip is cemented to the center top of the wing on the trailing edge, while the other is cemented to the leading edge.

The wing is now given one coat of diluted dope, which completes its construction. It is attached to the motor stick from its underside in a location to be determined by the tests which were spoken of before.



Drawings of the wing, propeller blank, and motor stick assembly. A single strand of 3/16-in. flat rubber forms the motor.

"The Greatest WORKSHOP BARGAIN I Ever Saw"

C. V. Olson, Instructor of Manual Training at Chicago's Greatest Technical High School Says:—

Gentlemen:

I want to congratulate you on the excellent value your workshop represents. It's the biggest workshop bargain I ever saw. Anyone with a knack for making things should be proud to own such a complete workshop. It's surprising to find such a variety of good tools, sufficient for practically every woodworking job, and all at such a low price.

Yours truly,
C. V. OLSON

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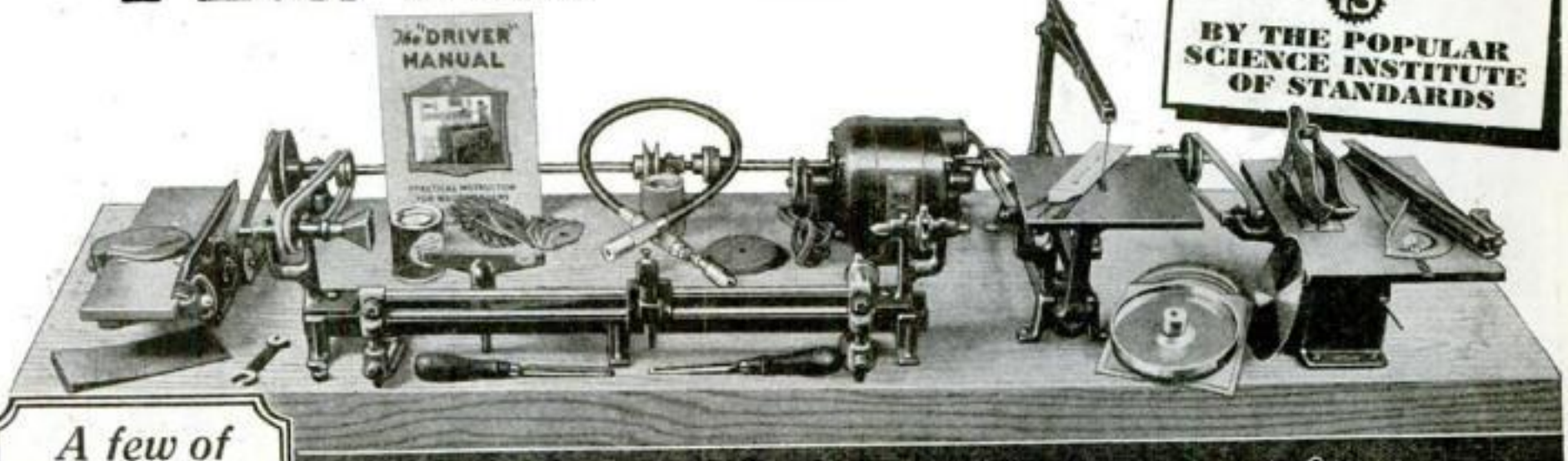

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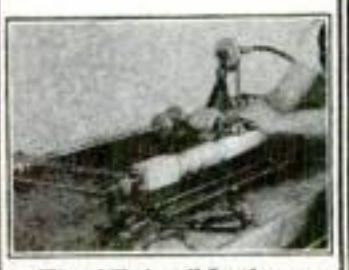

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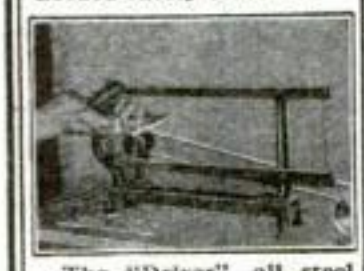

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Weather-Stripping a Door

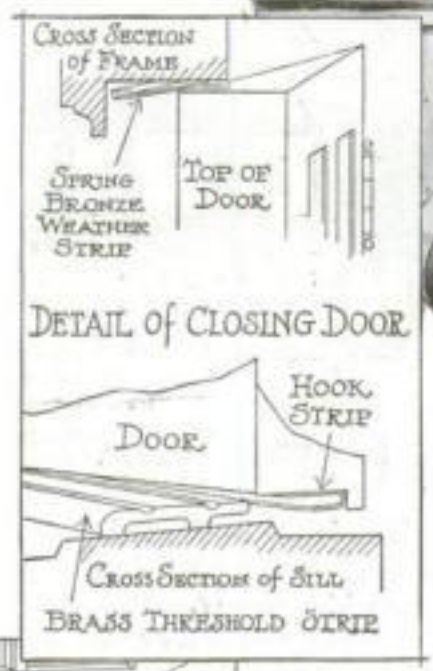
By
W. D. HEFFNER

Above: **Weather stripped doors prevent drafts.** *Left:* **Fig. 1. Weather-stripping at the top and bottom.**

THE basic principle in weather-stripping doors and windows is to close the necessary space in the joint without interfering with the free movement of the door or window.

A simple and effective form of weather-stripping for a door is a strip of spring bronze for the sides and top, and a metal threshold with an interlocking hook for the bottom. This combination was chosen for discussion because it illustrates most of the general principles of applying metal weather strips not already covered in last month's article on windows (P.S.M., Nov. p.108). There are other varieties of weather strips for doors, but in most cases they are applied like the strips on windows—a tongue and groove joint being used at the hinge edge and the interlocking type of strips on the three remaining edges.

On the bottom of the door, a strip of zinc or copper, fashioned into a hook, is rabbeted into the edge and interlocks, as the door is closed, with a threshold plate screwed to the sill (see Fig. 1). If the door has a wooden threshold which can be removed, the type of threshold strip shown in Fig. 9 may be used, and it is not necessary to rabbet the bottom edge of the door.



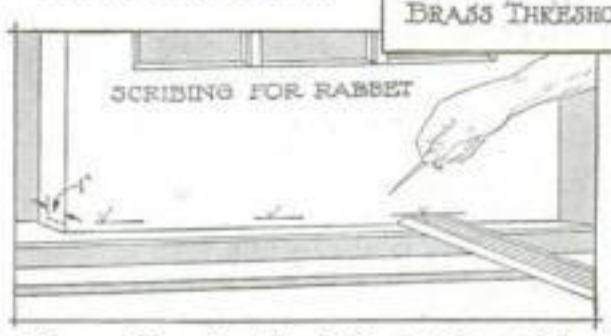


Fig. 2. How the threshold plate is used in marking the rabbet at the bottom of the door.

A plate patterned after that shown in Fig. 1 can be made at home by placing a flat ⅛ by 1⅛ in. bar of zinc or brass over a ⅛ by ¾ in. wood strip. The metal projects over the wood strip ⅜ in. and interlocks with the door hook.

A door that has more than ⅜-in. space in the joint should be refitted before applying the weather stripping by packing the hinge side with a sufficient thickness of wood strip to allow, when rehung, a ⅛-in. space at the joint. If the door sags on one end, square the top with the jamb so that the joint at both ends will be uniform in width. Then pack the hinge to obtain a ⅛-in. joint.

If the door has warped so that it does

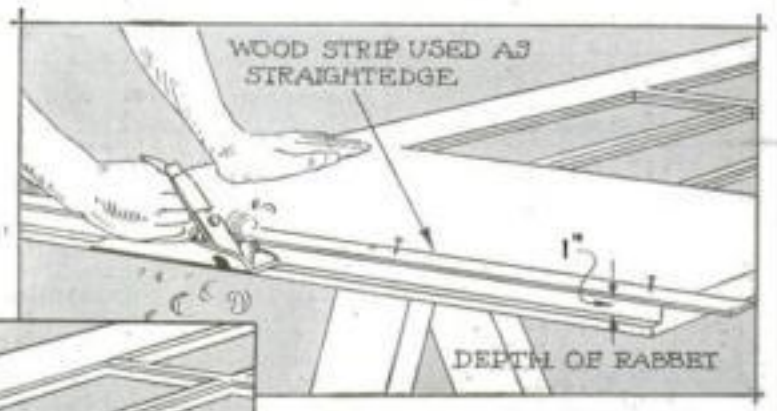


Fig. 3. A long wooden straightedge is nailed ⅛ in. above the line gaged in the manner illustrated in Fig. 2.

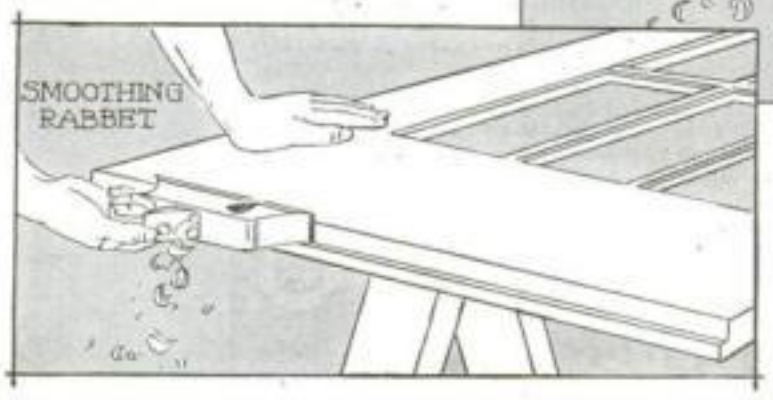


Fig. 4. Smoothing the rabbet formed in Fig. 3. An ordinary rabbet plane is used in both of these operations.

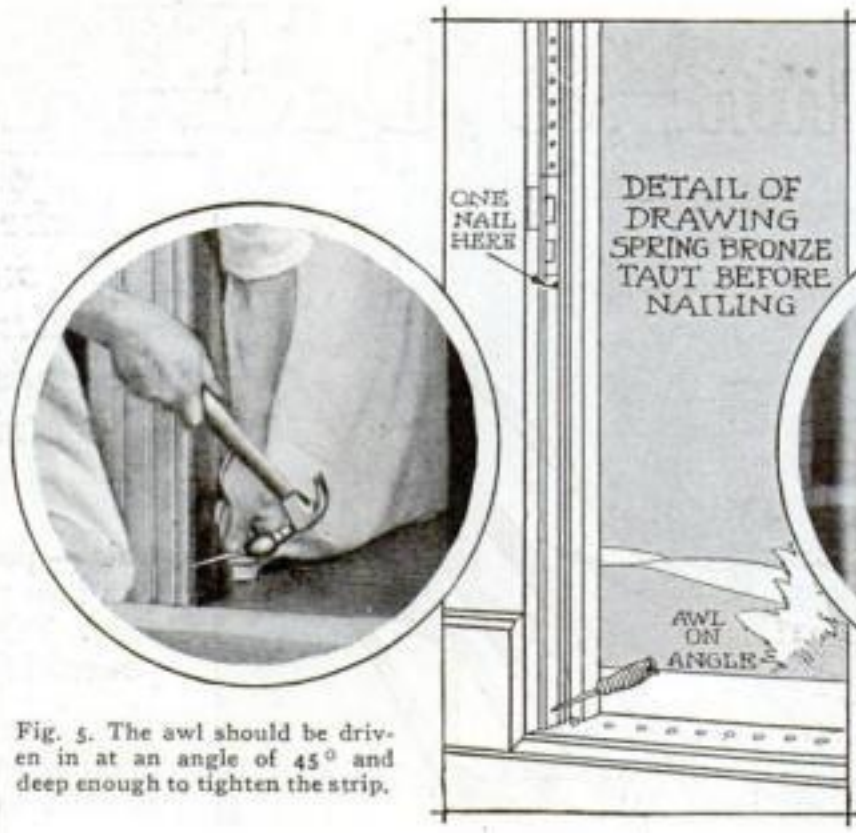


Fig. 5. The awl should be driven in at an angle of 45° and deep enough to tighten the strip.

Fig. 6. How the awl and one nail are used to draw the spring bronze stripping taut.

Fig. 7. By scoring a line just inside the nails, the strip is made to spring out.

not strike the jamb rabbet at the top, bottom, and center, the rabbet should be planed to remedy the difficulty. It may be necessary to reset the keeper.

After refitting, the first operation is to install the hook strip on the bottom of the door. Place the butt of the threshold plate against the bottom of the door, allowing it to rest on the sill. At the right angle formed by the plate and the door, make a mark with an awl (see Fig. 2).

Remove the hinge pins and take the door down. About ⅛ in. above the marks just made, nail a straightedge. This ⅛ in. allows for the thickness of the hook strip. Saw into the stiles about 1 in. deep at both ends and rabbet to this depth with a 1½-in. rabbet plane as in Figs. 3 and 4. If the door is 1¾ in. thick, the rabbet can be 1¼ in. deep. Nail in the hook with 1-in. coated nails, spaced about 1¼ in. apart (see Fig. 8).

Rehang the door and cut the threshold plate to fit inside the jamb rabbet. Place the plate on the sill and close the door over it several times to make certain that the hook meshes with the plate perfectly;

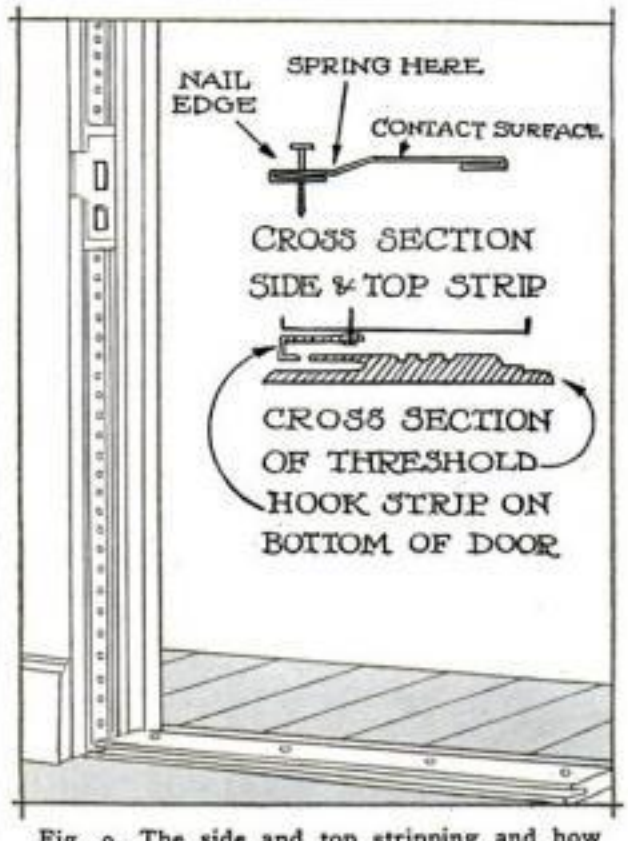


Fig. 9. The side and top stripping and how the hook and threshold strip are arranged when the original threshold can be removed.

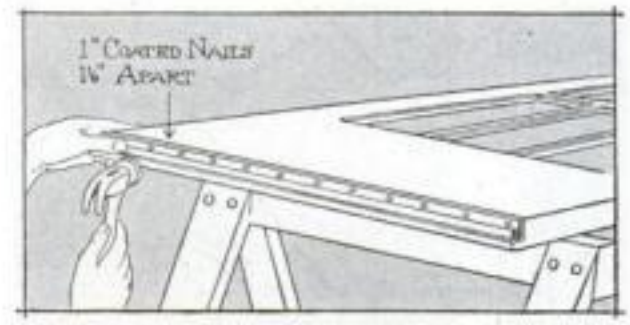


Fig. 8. The hook on the bottom edge of the door is held in place with 1-in. coated nails.

then screw the plate to the sill with 1¼-in. No. 9 screws.

If the sill is of stone, drill 1-in. holes with a 5/16-in. star drill and plug the holes with sheet lead rolled to size. Wax the screws before inserting them.

The top strip is installed next. Cut this piece at least 2 in. longer than the width of the door. Nail the end at the lock side in first with one nail placed ¼ in. from the door stop. The end at the hinge side is then trimmed shorter than the width of the jamb and fastened in with an awl instead of a nail. The awl should be driven in at an angle of 45°, and deep enough to draw the bronze as tight as possible (see Figs. 5 and 6). Then place a nail close to the awl. In nailing across, work from the center to the ends, spacing the nails about 1 in. apart. Use a ¾-in. copper or coppered nail.

When the top strip is installed, it must be sprung down to take up whatever space there is in the joint so that the door, when closed, will make contact with it. This is done by pressing a blunt screw driver or a pair of blunt dividers in the faint line dividing the nail edge from the contact edge, and running it clear across.

The hinge side is installed similarly with the exception that the nailing edge of the metal is placed next to the jamb rabbet so that it can be nailed as it passes the hinges.

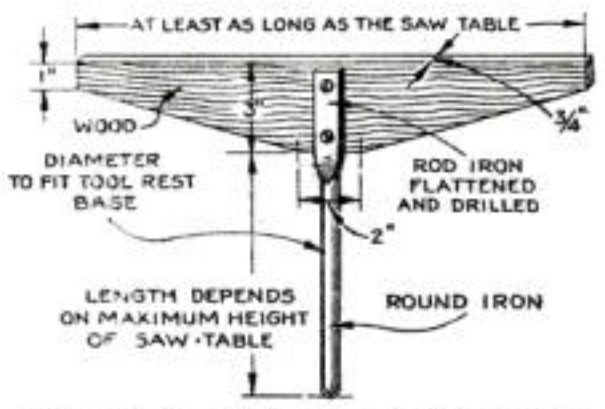
On the lock side, the metal is installed in two pieces, above and below the keeper, so that the strip will not interfere with the action of the lock (see Fig. 6). Both the lock and hinge side strips are then "sprung" until they engage with the door when closed (see Fig. 7). Wax all metal parts with paraffin.

T-REST EXTENDS RANGE OF SMALL SAW TABLE

LONG boards can be crosscut with ease on the small circular saws used with certain types of combination home workshop machines, provided a stock support is made like the one illustrated. The use

Crosscutting a long board, the end of which is supported on a special homemade T-rest.

of this device makes it unnecessary to have anyone hold up the end of a long board to be cut, and it enables the operator of the saw, alone and unaided, to do the cutting more accurately and with greater safety. Indeed, without some such support or a helper to hold up one end



Stock support designed for motorized workshops of the general type illustrated above.

it is exceedingly awkward and often dangerous to crosscut long stock.

The stock support is like a large wood-turning lathe tool rest, the upper part of the T being of wood and the upright member of iron, the diameter of which depends upon the size of the hole in the tool-rest base. Since the rod slides up and down, it is, of course, easy to adjust the support to conform to the height of the saw table.—JOSEPH J. LUKOWITZ.

KALSOMINING CEILINGS

IN PUTTING a new kalsomine finish on ceilings that have become blackened with smoke and grease, as is often the case in a kitchen, first wash off the ceiling with a strong solution of sal soda and water. After the ceiling has dried, apply a thin coat of shellac and then the new coat of kalsomine. Be sure that the ceiling is free of soot and grease before applying the shellac, or the darkened spots and smoky areas will show through the kalsomine.

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

An Air Yacht—Another Scale Model Whittled from Wood

By DONALD W. CLARK

The model has a 14-in. wing span.

BEING complete, even to the retractable wheels, the toy scale model of the Keystone-Loening Air Yacht illustrated forms an excellent addition to our series of scale models of modern aircraft that can be whittled from wood.

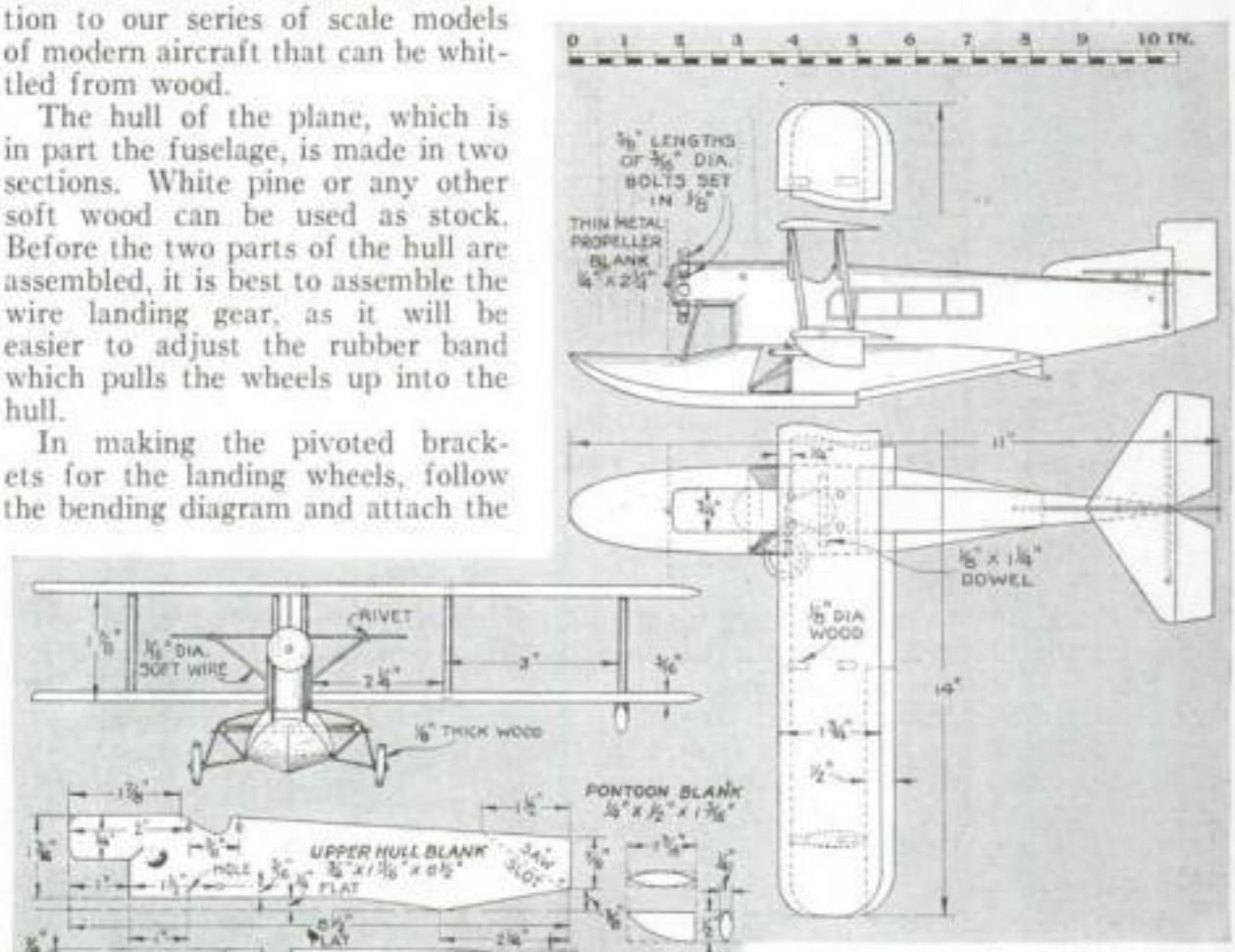
The hull of the plane, which is in part the fuselage, is made in two sections. White pine or any other soft wood can be used as stock. Before the two parts of the hull are assembled, it is best to assemble the wire landing gear, as it will be easier to adjust the rubber band which pulls the wheels up into the hull.

In making the pivoted brackets for the landing wheels, follow the bending diagram and attach the brackets to the lower part of the hull with nails as shown in the small perspective sketch. After the brackets are in place, the rubber band can be attached, and the wheels and piano wire spring, which holds the wheels in either the up or the down position, can be put in place. If desired, the rubber band may be omitted, in which case the wheels can be moved up into the hull by hand.

In assembling the wings, note that the lower wing is set back further on the fuselage than the upper wing. Lollypop sticks or small diameter dowels can be used for the wing struts.

The rear end of the fuselage is slotted to take the vertical tail unit, and the lower part of the hull is likewise slotted for the tail skid. Thin sheet metal is used for the tail units, tail skid, and propeller.

Color the top of the hull, vertical tail, pontoons, and all struts white; the wings and horizontal tail yellow; and the wheels and bottom of the hull red.



Assembly views of the air yacht model and details showing the construction of hull, tail, and landing gear.

A Christmas Gift

WHAT could be more appropriate as a Christmas gift to an air-minded boy than one or two of these scale models of modern airplanes? The choice is wide, as this is the ninth in the series, and little time is required to shape them from soft wood and paint them in the brilliant colors suggested in each article.

BLUEPRINTS FOR YOUR HOME WORKSHOP

TO ASSIST you in your home workshop, POPULAR SCIENCE MONTHLY offers large blueprints containing working drawings of a number of well-tested projects. Each subject can be obtained for 25 cents with the exception of certain designs that require two or three sheets of blueprints and are accordingly 50 or 75 cents as noted below. The blueprints are each 15 by 22 in.

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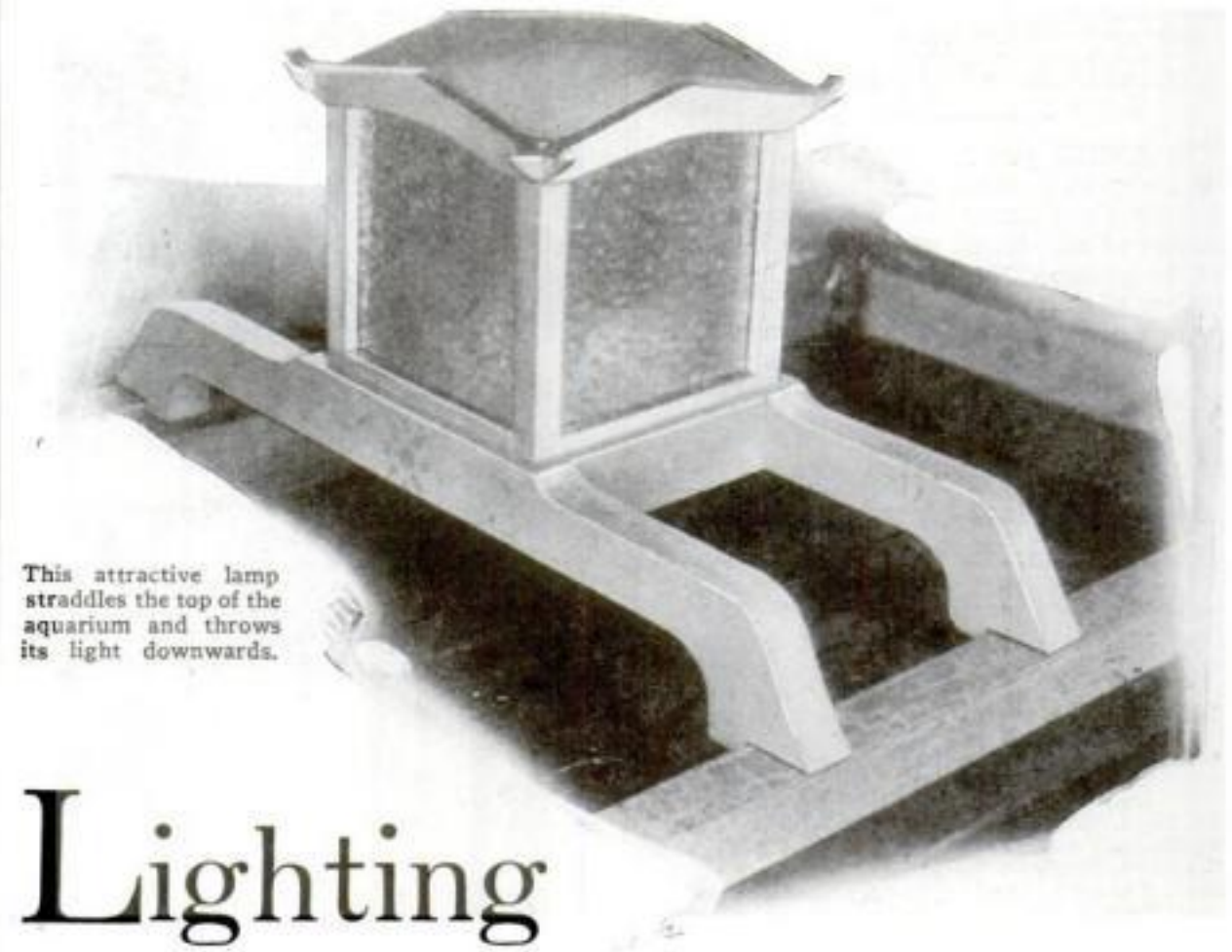


This attractive lamp straddles the top of the aquarium and throws its light downwards.

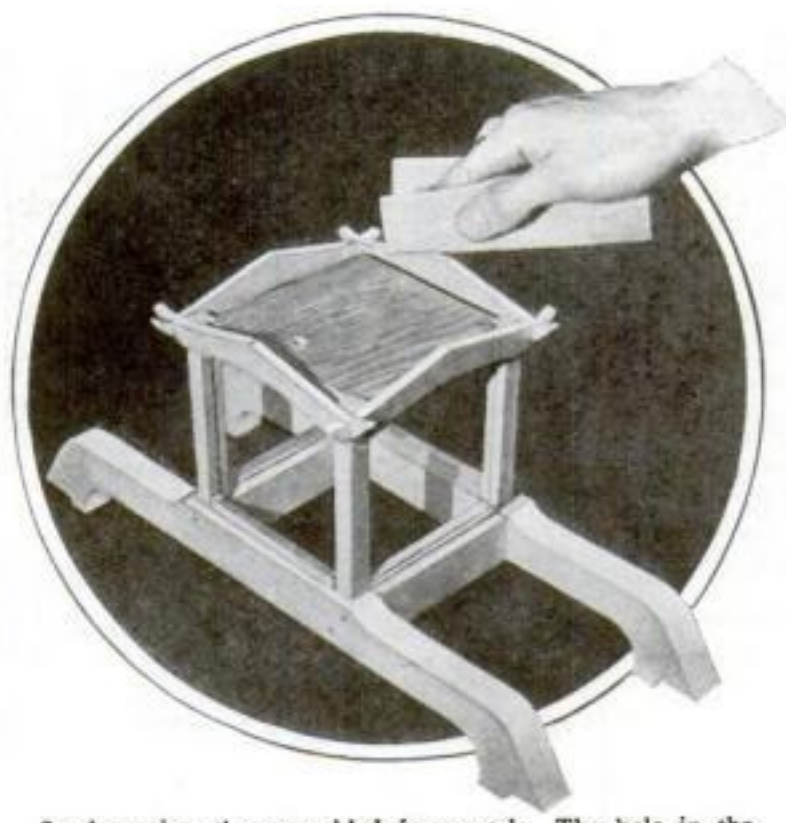
Lighting *Your Home* Aquarium

By WALTER E. BURTON

ALTHOUGH the home aquarium is one of the most instructive and attractive ornaments, its beauty is almost, if not wholly, lost at night without proper illumination. This is especially true of large rectangular tanks.

A small book lamp with a clamping base, if placed behind the aquarium or at one end, will serve to light the tank, but it is not wholly satisfactory. The most natural point from which light can come is directly above the water surface. The contents of the tank are then illuminated properly without the presence of any glare to cause eyestrain. For best results the lamp should be within a few inches of the water.

To meet these conditions, you can construct a simple and inexpensive lamp that rests on bridgelike legs extending across the top of the aquarium. The design illustrated is somewhat Oriental, but it can be easily varied. Dimensions given are only approximate, as the cross members must be constructed to fit the tank. For a small aquarium, the size of the lamp compartment can be reduced, and a smaller bulb used.



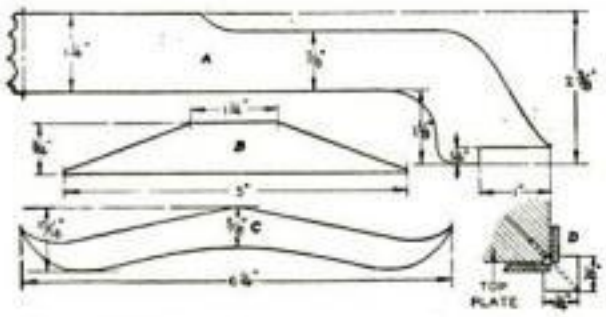
Sandpapering the assembled framework. The hole in the top plate happened to be in the wood; it is not required.

The two cross members are cut with a band, jig, or scroll saw from ¾- or 1-in. stock. Poplar, gum, maple, or other wood not too easily split is suitable.

The lamp house consists of a wood frame with glass sides. The porcelain socket is mounted in the center of a top plate made from plywood or other thin material. Each of the corner pieces is ½ in. square and is grooved on two sides to receive the glass panels. You will note from the drawings and photographs that the top plate to which the socket and corner pieces are fastened is small

enough to permit the glass sides to be slid into place.

The curved sidepieces of the top are cut from ¼-in. stock with a scroll saw and are held in place with glue and small nails. Four of the projecting corners must be glued into place; the other four are con-

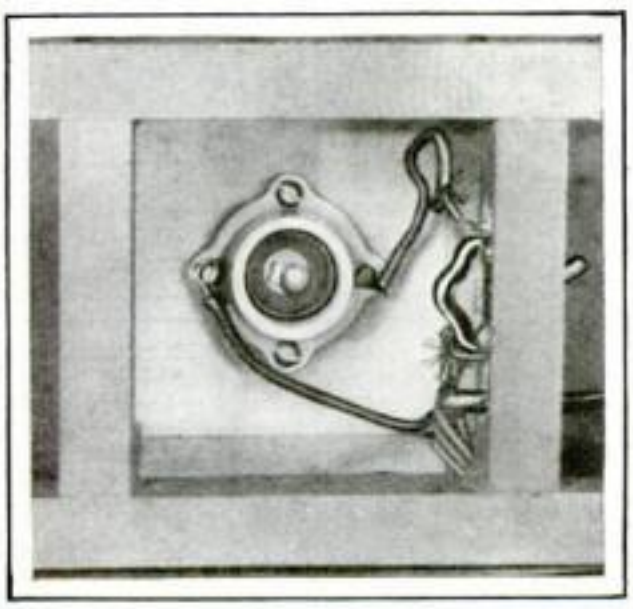


Suggested shapes for cross members, "roof," and sidepieces, and the corner construction.

tinuous with two of the sides. The "roof" piece that completes the lamp house is shaped from ¾- or 1-in. stock, its beveled surfaces being formed with a saw and plane.

You can use almost any translucent fireproof material for the sides of the lamp compartment. In the lamp illustrated, colored package wrapping paper was fastened to glass rectangles with shellac. The shellac increases the translucency of the paper; however, the paper or other material should not be transparent enough to make the lamp glaring. Do not use celluloid or other inflammable material.

The wires enter the lamp house through a hole in the rear crosspiece that connects the two legs of the lamp. The bottom of the lamp house is open, both for ventilation and to allow the light to strike the water. Because of the heat produced, the bulb should be no larger than necessary for adequate illumination. It is a good idea to cover the inside surfaces of the wood corner pieces and the wood plate at the top with sheet asbestos, if you find that



Interior showing socket on asbestos-covered top plate, and toggle switch placed at back.

too much heat is developed or if you use a large bulb. Colored lamps give striking effects.

The lamp illustrated is finished in Oriental red lacquer with gold bronze trimming. Take pains to finish the undersurfaces carefully because they are seen clearly reflected in the water.

The porcelain socket has no switch. The lamp can be controlled by a switch in the cord or a small 110-volt radio toggle switch placed at the back. The latter is the neater and more convenient method.

Bands of imitation inlaying, which are very easily applied, can be used to embellish many otherwise plain wood turnings.

Trick Ways of Inlaying

By
JACK ROOD

THERE are several ways to obtain striking inlay effects on turned woodwork without going to the trouble of using wood inlays. For instance, instead of filling the groove for the inlay on a bowl or other piece of circular work with a strip of carefully cut wood, you can fill it instead with lacquer of a color to contrast either with the natural wood or with whatever finish the wood is to be given.

The groove should not be deep; in fact, 1/32 in. is sufficient. If you plan to give the wood a natural finish, turn and smooth the piece, then give it a darkening coat of stain and wipe off the surplus. Next cut the groove. Take off the faceplate, with the work still screwed to it, and set it level. With the aid of a toothpick, fill the groove entirely with lacquer of any desired color that will contrast well with the wood. Two fillings may be necessary, for the colored band should be a trifle higher than the wood itself. When the ribbon of color has dried, put the work back on the lathe and dress the lacquer down flush. Finally, give the whole piece a coat of clear lacquer, and rub down and polish the surface. If the entire piece is to have a coat of colored lacquer, apply the body coat (or coats) to the wood, let it dry, and rub it down before cutting the groove or grooves. This will insure sharp, clean-cut edges. The contrasting lacquer should be applied as previously

Above: Bowl with two light blue inlaid bands formed of lacquer. *At left:* Another bowl which has ridges that are later cut away.

Applying a high-grade black drawing ink to give a wood turning the appearance of ebony.

described, and when dry it should be dressed flush and the whole piece well polished.

Another novelty inlaid effect can be obtained with hardwoods by leaving slight ridges of the wood where the contrasting lines are to occur. The whole piece is then enameled or lacquered in the chosen color, and when the color is dry, each protruding ribbon of wood is turned down flush with the rest of the surface. If the stock is close grained, there will be a neat line of the natural colored wood showing, and this forms the contrasting band or bands.

Good imitation ebony effects may be obtained by rubbing the wood, while it is revolving in the lathe, with a soft rag soaked in high-grade black drawing ink. Since the ink penetrates readily into the wood, you can develop any desired tone of black in this way. Ink applied in this manner also penetrates through any stain which has just been applied, therefore some novel combinations are possible. You can "doctor up" favorite woods such as gum or walnut so that even an expert will hardly recognize them. And if the black ink is applied to any wood, you will obtain a jet black color that is very much like ebony.

These black tones sometimes may be used in combination with the novelty imitation inlays previously described. Rub the wood to obtain a good luster and to prevent any of the black coming off with handling, and apply a final coating of clear lacquer, shellac, or varnish.

WIPER KEEPS DIRT FROM BENEATH SURFACE GAGE

A ring of felt attached to the base of the gage automatically cleans the surface plate.

MACHINISTS and toolmakers are well aware of the trouble often caused by dirt which gets beneath a surface gage and makes a lay-off inaccurate. Most mechanics keep wiping the surface plate with their hands to avoid this, but recently I tried out an automatic method of keeping the plate clean whenever the surface gage is used. The base of the gage is surrounded, as illustrated, by a metal ring or collar, to the outside of which is attached felt or thick cloth. Then wherever the surface gage is moved, the collar goes along with it and wipes the plate clean.—H. MOORE.

GAS water heater coils should be cleaned occasionally with a stiff bristle or wire brush to remove the soot.

Testing the Glue You Use

By W. H. HAMMOND

A GOOD joint requires good glue. Experience proves that it is better shop practice for the woodworker to make a few tests on any batch of glue of which he is uncertain and then throw the material out if it fails to stand up, than to go ahead and construct weak joints with it.

Poor glue that lacks the essential "sticking" quality cannot be saved by using it thicker, as such a mixture fails to penetrate the fibers of the wood and makes a weak, superficial joint.

The tests to be described closely follow official government tests and offer to the woodworker who takes pride in his work a simple and accurate method of selecting high-grade liquid or hide glues.

A glue of good working consistency should be liquid at 60° F., should comply with the so-called "bubble" test at 68° F., and should make a joint which will stand a pull of 300 lb. per square inch. A liquid glue can be tested directly. A hide (solid) glue must be mixed in the pot in the usual manner and the mixture tested in the same way as a liquid glue.

To make the first two tests, a couple of test tubes ½ in. in diameter should be bought at a drug store. Fill the two tubes with the liquid glue to within a short distance of the top and stopper them, leaving exactly ⅜ in. between the bottoms of the stoppers and the glue. The distance is important. The tubes are now immersed for half an hour in cold water, which should be held at 60° F. If the temperature of the water rises, it should be cooled by the addition of cold water or with chips of ice.

At the end of half an hour, the tubes should be removed and inverted, and the condition of the glue noted. A certain amount of stiffness is allowable in a mixture of good working consistency at this temperature, but the glue should still be able to flow, otherwise it is too thick to penetrate wood properly. The tests are performed in duplicate for the sake of greater accuracy.

To perform the second or bubble test, add enough warm water to the cold bath to raise the temperature to 68° F., immerse the stoppered tubes in the water, and hold the temperature constant for another half hour by occasional additions of either hot or cold water as necessary. Then hold the tubes upright so that the bubbles of air above the glue surfaces are immediately beneath the corks. Quickly turn the tubes bottom up, so that the bubbles will have to rise through the entire length of the glue. With the second hand of a watch, determine the exact time taken for the bubbles to rise 4½ in. of the tube distance. In a properly mixed glue, this time, which is a rough index of the viscosity or flowing quality, should be between thirty seconds and three minutes.

The last, or strength test, is more troublesome than these first two, but it offers the surest means of arriving at the exact value of a glue. It is a simple shop modification of the old block test, in which glued blocks are pulled apart in a tensile strength machine. With a good glue, the wood itself will frequently break first in this test.

To perform it prepare, for gluing end to end, two seasoned hardwood blocks, preferably of maple, 2 in. or more in length and exactly 1 sq. in. in cross section. The surfaces to be joined must be square-cut, smooth, plane, clean, and dry. Brush a thin coat of glue on each surface and allow to dry to a slight stickiness. Then apply a second coat in the same

Making the bubble test, which gives a rough index as to the viscosity.

The temperature bath can be controlled by the addition of either cold or warm water or ice.

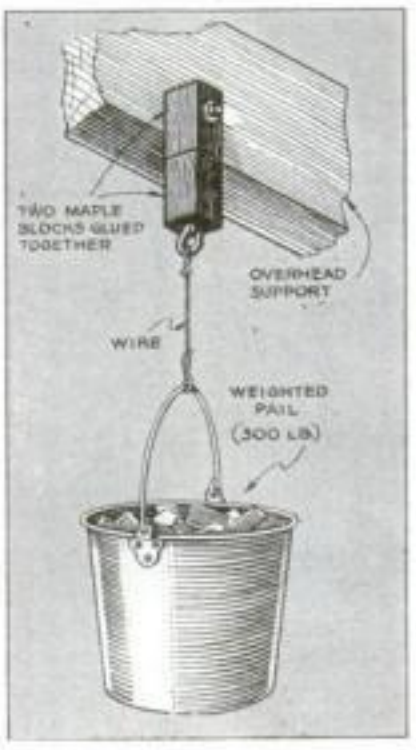


Diagram showing a simple way to test the strength of glue.

way. When the second coat has dried to the same state, join the two blocks and dry for forty-eight hours under pressure. The pressure may be obtained in a vise or a homemade press of some sort, delivering approximately 15 lb. A simple vertical press using this actual weight in metal will serve the purpose.

At the conclusion of the forty-eight hours, one of the blocks is bolted or otherwise firmly secured to an overhead support, such as an overhanging beam in the shop. The lower block should hang immediately below the upper, so that the pull on the joint will be vertical. The bolt and beam must be strong enough to stand a pull of 300 lb. An ordinary iron pail is now weighed, and enough old metal or other weights are added to bring the total to exactly 300 lb.

The pail is emptied and suspended from the lower block by means of a bolt, hook, or strong wired connection. Then the weights are gradually added to the pail to give a total pull on the glued joint of 300 lb. A good glue will stand this and more.

Strictly speaking, the weight of the wire should be added in when computing the pull, and also the test should be made at a room temperature between 70° and 90° F.

SHIP MODEL PHOTO USED AS CHRISTMAS CARD

HAVE you ever thought of making Christmas cards by coloring photographic prints of your favorite ship or stagecoach model? James W. Blair, of Buffalo, N. Y., used his model of the Spanish Galleon as a subject for the card illustrated below.

Almost any kind of decorative handiwork can be used in making these photographic cards.

FAHRENHEIT temperature can be readily converted to centigrade by the following formula: Temperature centigrade = 5/9 (Temp. F.—32). For example, suppose we desire to know what 60° F. is in terms of degrees centigrade. Substituting we have: Deg. C. = 5/9 (60-32) = 15 5/9° C. Degrees centigrade can be converted to degrees Fahrenheit by the following formula: Temperature Fahrenheit = 9/5 (Temp. C. + 32).

You Can Improve Your Garage by Applying Wall Board

By

GEORGE H. VAN WALTHER

A wall board lined garage can be kept warmer and cleaner.

BEING both inexpensive and easy to apply, wall board forms an excellent material with which to line the rough lumber, cement, or brick walls of your garage. If you can drive a nail, you can apply wall board, so simple is the process.

Besides its perfect finishing qualities, wall board is relatively cold- and heat-proof and will exclude dampness, transforming your garage into a place for housing a home workshop as well as a car.

Wall board, as made by a number of manufacturers, can be obtained for from four to six cents a square foot, a great saving over lath and plaster, which costs approximately eleven cents a square foot for a three-coat plaster application.

Since panel widths of 32, 48, and 64 in. are obtainable (16 in. being the general center-to-center distance between wall studs), it is a simple matter to reduce all cutting and fitting to a minimum and still have the joints between the boards come in about the center of either the third, fourth, or fifth wall stud according to the width of panel used. These panels are sold in 6, 7, 8, 9, 10, 12, 14, and 16 ft. lengths, allowing a wide range of choice.

Plan the arrangement of the panels carefully on paper before purchasing the material; then you should encounter little difficulty in obtaining a workmanlike job with the least amount of waste. If the garage is a frame building, the problem of attaching the wall board is a simple one, the studs offering a backing for the board. If it has cement or brick walls, they must first be coated with asphaltum and then ⅞ by 2 in. furring strips applied with nails and wood plugs. Wall board can also be applied over plaster in a similar manner with the exception that the application of the asphaltum is omitted.

In frame structures, backing is required at the corners and around all lighting switches and fixtures since wall board must be supported on all free edges if the best results are to be obtained. (See Figs. 2 and 5.) This is especially true in applying wall board to ceilings.

Test the studs, or furring if the walls are of cement or brick, with a straightedge. If any of them bow out, shave off the excess wood; if any bow in, place a saw kerf along the outer edge and force the stud out by driving a wedge between the stud and the outer wall (see Fig. 5). The success of any application of wall board depends to a large extent on the levelness of the surface to which it is applied. This is especially true if you intend filling the joints with a crack filler instead of applying decorative wood strips.

Whatever cutting or fitting is necessary can be accomplished with a fine tooth saw or by cutting the board halfway through with a sharp knife and bending it along the cut until it breaks. Check yourself several times before making a cut to prevent waste of material through error.

The ceiling panels are

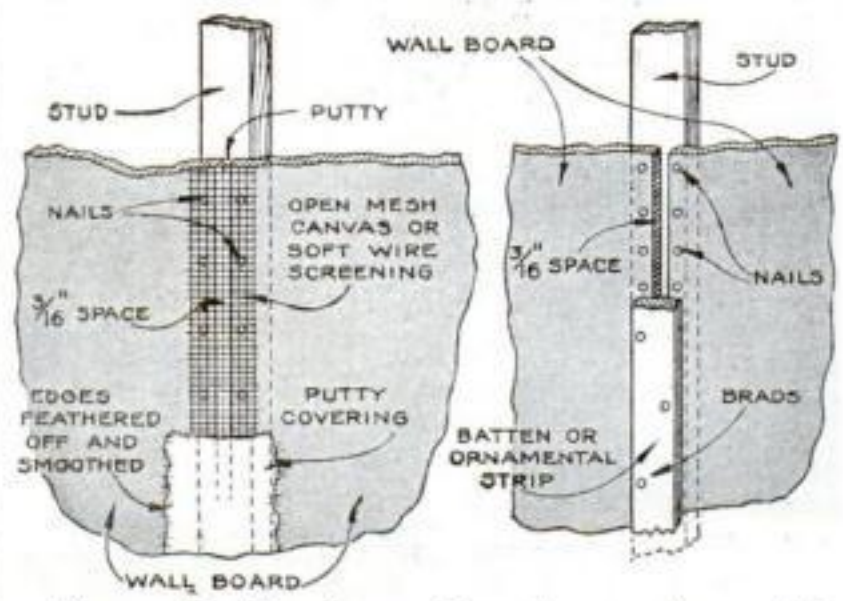


Fig. 1. The joints between the sections can be concealed with ornamental strips or covered over with a special putty.

placed first. One man can accomplish this with the aid of the T-brace shown in Fig. 4. This brace serves to support the one end of the panel while the workman nails the other end in place. Backing must be placed between the floor joists where the joints between the sections of wall board comes. Furring strips attached to the underside of the beams can also be used, if desired.

Wall board panels can be fastened by one of two methods, either by attaching the centers of the panels to the intermediate studs with patented fasteners such as shown in Fig. 3 and nailing the outer

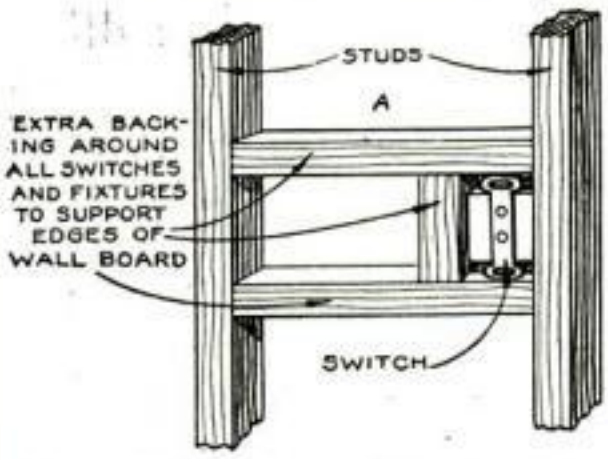


Fig. 2. Backing for the wall board must be placed around all switches and fixtures.

edges with 1-in. No. 16 flathead nails, or by fastening the centers with 1-in. No. 16 brads and the outside edges with 1¼-in. No. 16 flathead nails as shown in Fig. 5. In either case, however, a space of 3/16 in. should be left between adjacent panels unless otherwise specified by the manufacturer of the particular wall board you are using.

After the ceiling has been completely covered, the paneling of the side walls can be started. Apply the wall board carefully, fastening it at the upper edge first,

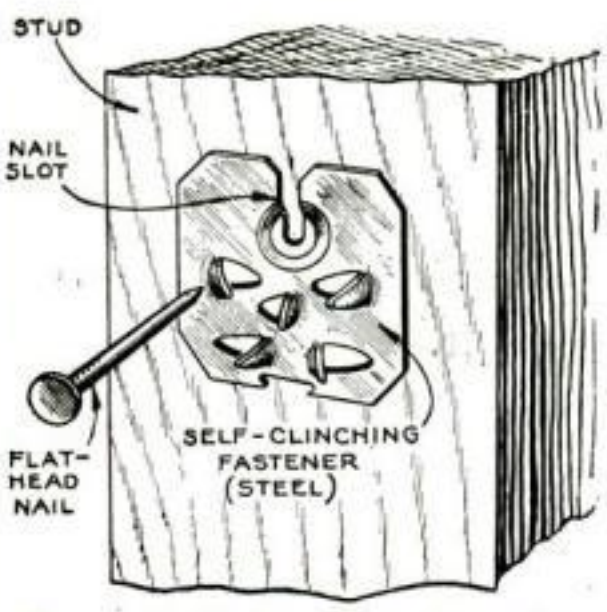


Fig. 3. Special fasteners may be used to hold the centers of the panels in place.

marking the positions of the intermediate studs on the outer surface of the board with a chalk line, driving the intermediate brads into the studs (or using a block to clinch the special fasteners), and then fastening down the edges with the flathead nails. It is best to start the side paneling in one corner of the garage as shown in Fig. 5.

As each panel in the ceiling and wall are placed, go over the intermediate brads and countersink them well below the surface. This operation will not be neces-

sary, of course, if the patented fasteners shown in Fig. 3 are used. These fasteners also have the advantage of allowing the wall board to be removed without injury to the outside surface and finish if this becomes necessary for the installation of additional wiring or other reasons.

The joints between the panels can be concealed either with wood strips (preferably used only when the planning has been accurate enough to bring the joints into a well-balanced and uniform group of panels) or with a putty or crack filler that will bring the sections of wall board into one smooth surface similar to that of a plaster wall. These two methods are shown in Fig. 1.

IF the putty method is used, the joints are first coated with a glue size in order to provide a filled surface for the putty. Various putties are sold for this type of work, but an excellent substitute is thick plastic paint. Fill each joint with the putty and allow it to spread over the boards for a distance of 2 in. While the putty is still wet, place on it a 3 in. wide strip of open-mesh canvas or special soft metal screening sold for the purpose. Pound this down into the putty with a stiff brush and then apply more putty over the top, scraping it down as the work progresses with a broad putty knife. The putty should be feathered out at the edges and worked down into a smooth surface, the whole being kept as thin as possible. If applied correctly, this should form a joint that will not crack nor pull away under average settling and weather conditions.

A number of panel strips or moldings, often called "batts," can be found at any well-stocked lumberyard, a good size being ½ by 1½ or 2 in. These strips can be applied with or without mitered corners. The brads that hold these strips in place should be staggered as shown in the right-hand sketch in Fig. 1.

While inside wall paint is available in a large variety of colors, white or a light buff is the best in garages since it reflects the light and is cheerful. The first coat should be a mixture of two thirds paint and one third hard drying varnish. Where decorative wood strips are used to cover the joints the first coat should be applied

Fig. 4. How the T-brace is used. A piece of wood serves to protect the wall board from hammer marks when the fasteners are clinched.

before the strips, and the strips also should be given a priming coat. Before applying the second coat, fill over all countersunk brads with a mixture of whiting and white lead or the sediment found at the bottom of the can of paint you are using. The second coat, which in the case of a good grade of board will be sufficient, is used straight from the can. Apply the paint with a wide brush, using long, even strokes. A pleasing effect can be obtained by stippling the second coat.

If "batts" are used and it is desired to stain and varnish them rather than paint them, fill the nail holes with a prepared wood putty. The strips then can be stained to suit the individual taste.

The application of wall board varies in some minor points with the different brands, so it is well to study the directions supplied by the manufacturer of the particular wall board that you are using before going ahead.

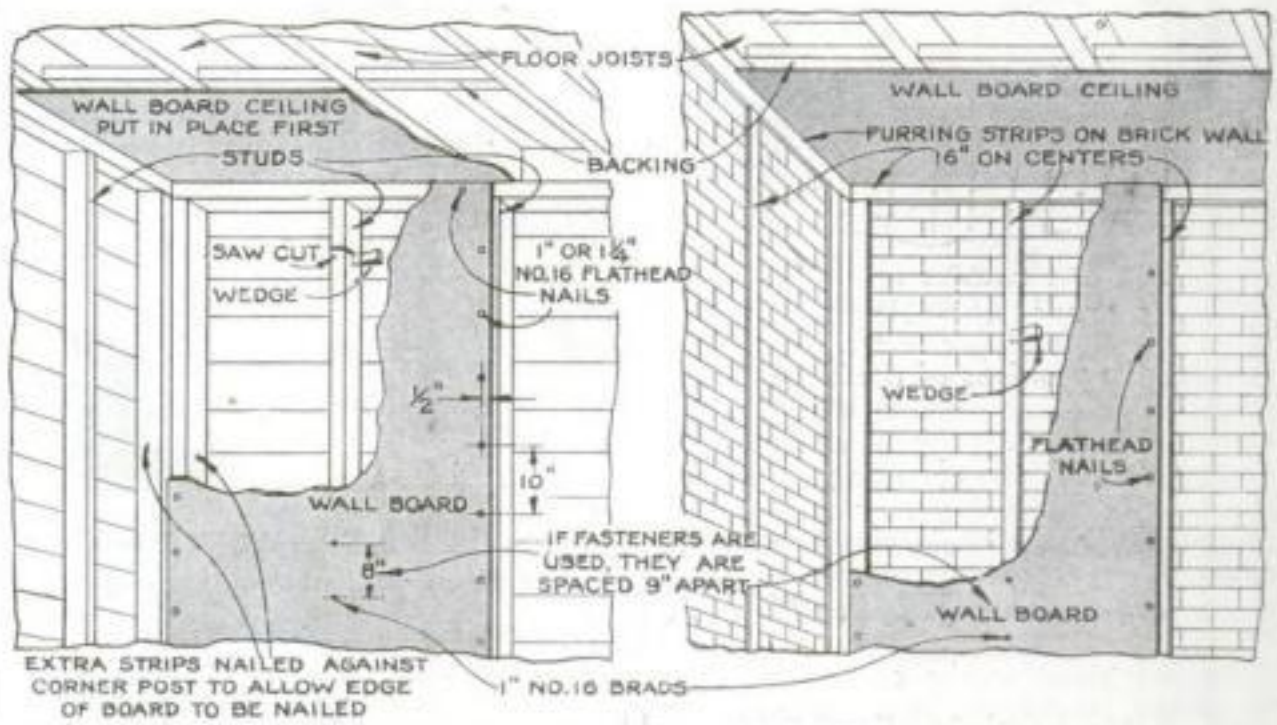
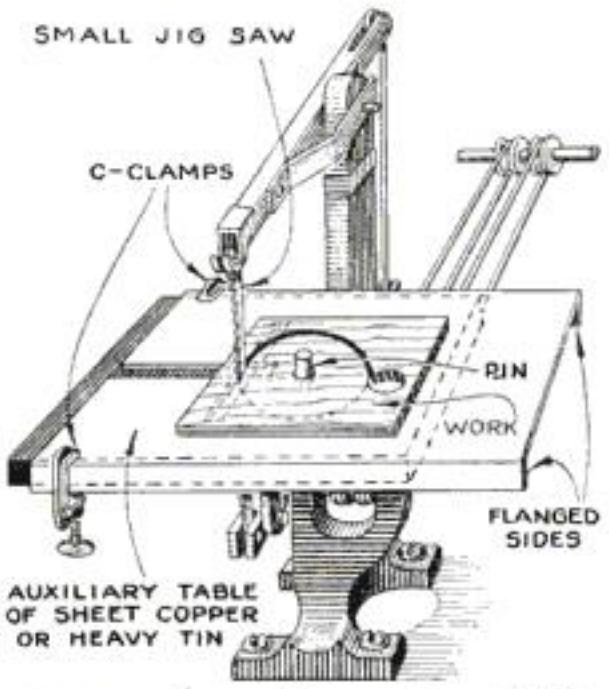


Fig. 5. If the garage is a frame structure, the panels may be applied directly to the studding, but if the building is stone, cement, or metal, furring placed 16 in. on centers must be applied to the walls.

JIG SAW ATTACHMENT FOR ROUND WORK

MODEL makers, especially those interested in coaches and covered wagons, can simplify the work of cutting wheels and rims by making the attachment illustrated, which may be used on any type of jig saw. It is an auxiliary table or plate made of copper or heavy

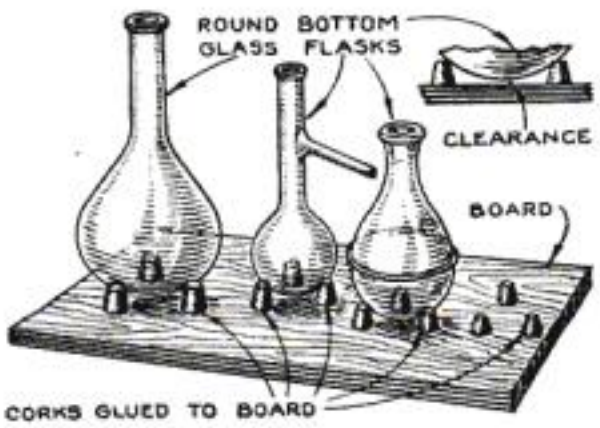


The part to be sawed is mounted so that it can revolve on a pin in the auxiliary table.

tin with flanges to keep it in position and a notch for the saw blade. Immediately behind the notch a brass pin is soldered. This pin is the pivot upon which the work is turned while being cut, and the radius of the circle is determined by the distance between the pin and the saw blade. Small C-clamps secure the plate to the jig saw table.—HENRY B. COMSTOCK.

STORING ROUND-BOTTOM CHEMICAL FLASKS

A STORAGE shelf for round-bottom flasks used in chemical experiments may be made by gluing corks to a shelf as illustrated. Three corks are needed for each flask, and they should be spaced so that the bottom of the flask does not touch



Method of using corks to support the round bottoms of chemical flasks on a shelf or board.

the board. This is a handier and safer way to store these flasks than in a drawer or cupboard, where they are usually kept without any provision for their proper separation.

Single boards with corks glued on in the same way are also a convenience to have on the workbench when using round-bottom flasks.—HARRY B. MAXWELL.

Marbleizing with Paint

A small piece of natural marble may be used as a pattern in simulating the figure of the stone.

By BERTHA ANNE HOUCK

MARBLEIZING is a means of ornamenting walls and woodwork that is being used more and more by home owners and decorators. In well-executed imitations of marble accomplished with paint, the effect has much of the attraction of the natural stone and at the same time is much less expensive and easier to handle. In addition, simulated marble effects may be used suc ssfully in a small, simple room where the genuine stone would be too formal and imposing.

The entire woodwork or wall space of a room may be marbleized, but ordinarily this type of decoration is more restricted. It is a frequent means of finishing a dado and is popular for fireplace frames and mantels. Now that the bathroom is often given more elaborate treatment than was thought necessary in former years, marbleizing is an appropriate means of finishing the woodwork. Marbleizing also lends itself well to garden furniture, such as seats, bird baths, and pedestals.

Marbleizing will often bring a fireplace into closer harmony with an existing color scheme.

Patience and paint are the requisites for the job of marbleizing. As real stone is to be simulated, it is well to have a piece of marble at hand to copy the veining and color. As there are thirty or forty kinds of marble to imitate, the color combinations are numerous, and the homeworker should encounter little difficulty in choosing the correct colors for the particular room in question.

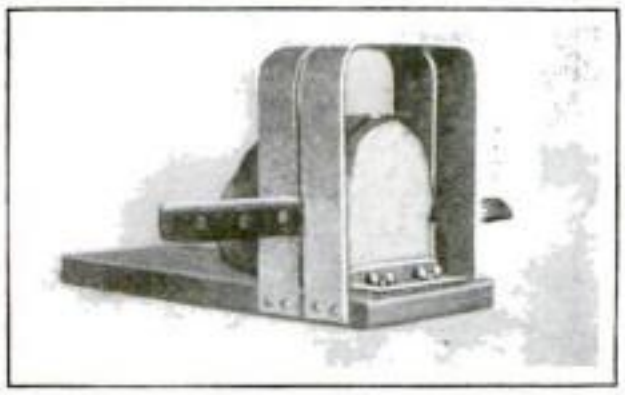
Suppose a piece of ordinary black and white marble is to be copied. After the surface has been properly sandpapered and given a suitable priming coat of paint, a coat of flat white paint is brushed on. When it is dry it must be sandpapered smooth. Then a coat of ordinary enamel (not quick drying) should be applied, or a coat of white paste paint, such as is used by professional painters, mixed with three parts of oil and one part of turpentine. While this coat of enamel or paint is still wet, a small ox-hair pencil (a special painter's brush) or a feather, whicl is just as satisfactory, is dipped in a little lampblack ground in japan. The lampblack comes ready prepared in tubes or tins, but it will be necessary to thin it with turpentine to a workable consistency. With this black paint the veins are traced in the wet body paint in imitation of the real marble. There is no need for great exactness here, because the markings themselves present great irregularities. All that is necessary is to follow the general trend of the figure in the sample piece of stone.

With a badger blender (another special brush obtainable at any well-stocked paint store) the black and white are lightly blended together until the dividing lines are very faint. The result will be found to be a satisfactory imitation of the real thing.

A light gray background with veinings in dark gray or black makes a very good imitation. For the daintier room, a pink background marked in green or tan is both authentic and decorative.

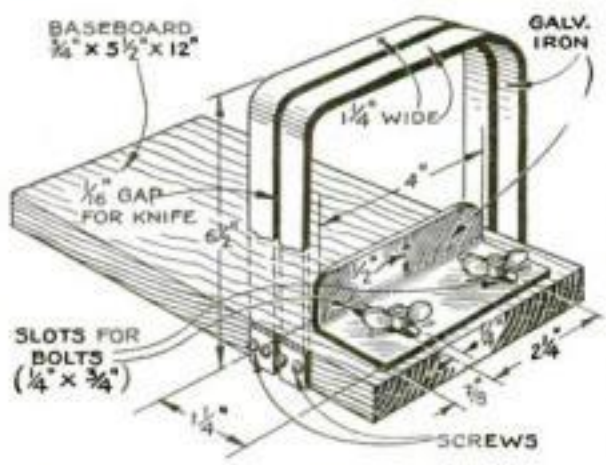
BREAD GAGE INSURES UNIFORM SLICES

ALTHOUGH it costs only about twenty-five cents to make, the bread slicer illustrated allows one to cut uniform slices of any desired thickness. I have found it a great advantage when cutting a large number of slices for sandwiches where, of course, uniformity and speed are desirable.



Uniform slices of bread can be cut very rapidly with the aid of this homemade slicing gage.

The base is a board ¾ x 5½ by 12 in. As the total height is 6½ in., two strips of fairly stiff galvanized iron 1¼ in. wide and about 19 in. long will be needed. Another piece of the same material is used for the stop or thickness gage. The long strips are bent to shape and fastened with eight screws, a gap of about 1/16 in. being left for the knife. Make the thickness gage as shown in the drawing below, and fix two ⅛ by 1¼ in. bolts securely into the base so that wing nuts can be used to fasten down the gage in the desired position.—RICHARD L. GRAVES.



How the knife guide and adjustable thickness gage or stop are attached to the bread board.

SHIP MODEL SHORT CUTS

FISHING swivels, ⅝ in. long and sold two for five cents, can be used to simulate turnbuckles on ship models. For decorative models, one of the swivel rings is fastened to the shroud or backstay and the other is fastened to an eye pin in the deck. When used on practical sailing models, the lower ring of the swivel is looped through the hook of a screw eye, which is then bent closed and screwed into the deck until the proper tension is obtained.

In making glass portholes, the writer glues ⅜ in. diameter brass rings to a sheet of celluloid similar to that used in automobile side curtains and, after the glue has been allowed to dry thoroughly, cuts them out carefully with a pair of sharp scissors.—E. W. MARSTON.

Simple Plumbing Repairs

What to do when your faucets drip and tanks and pipes spring leaks

By

W. M. BUTTERFIELD

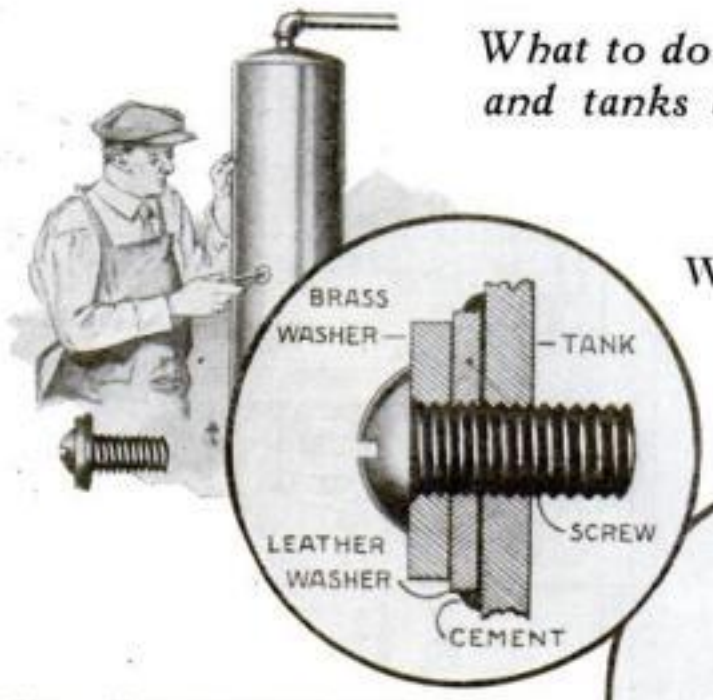


Fig. 1. How a screw and washers can be used to plug a small leak in a water tank.

WHEN armed with the knowledge of a few simple "whys and wherefores," the amateur mechanic should encounter few difficulties in making minor repairs to the plumbing system in his home. Small repairs take but a few minutes when you know how, and in making them yourself you can easily reduce the maintenance costs.

Is it possible to repair a water tank that has a small pinhole leak?

An easy way to repair a small leak in a water tank is illustrated in Fig. 1. First, shut off the water supply and drain the tank. Enlarge the small hole with a 1/8 in. diameter twist drill and inspect the hole to see whether or not you have made it large enough so as to obtain a solid wall for the entire thickness. If not, the hole may be made larger by using a 3/16-in. drill. This procedure can be continued, if necessary, until a hole 3/8 in. in diameter is obtained. Next, tap the hole, using a tap corresponding to the final diameter of the hole. Place a brass washer and then a leather washer of larger diameter on a brass screw that will fit in the tapped hole. Coat the inside surface of the leather washer with boiler or radiator cement and place the screw in the hole, tightening it up until the cement begins to ooze from under the leather washer. Allow the cement to stand this way until it begins to harden and then turn the screw up tight. In about half an hour the tank can be filled with water.

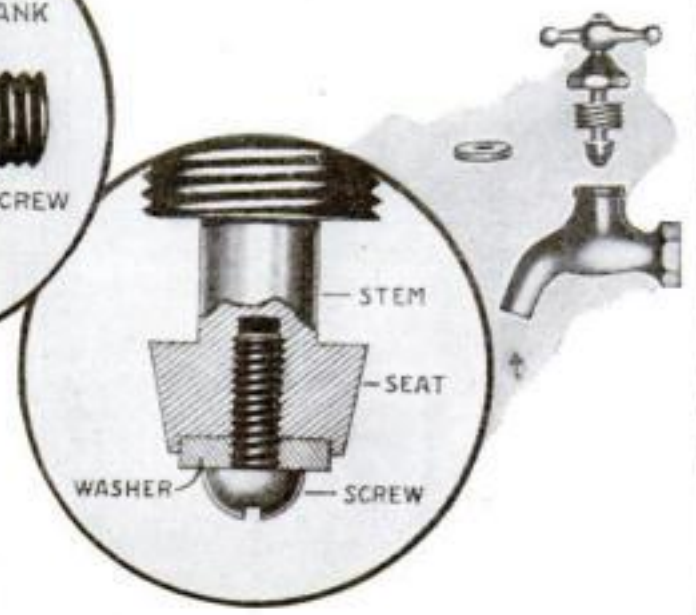


Fig. 2. If a compression faucet drips when it is turned off, the washer needs replacing.

What causes a faucet to drip when the handle is turned to the off position?

This, like the condition where a low rumbling noise is heard even when the water can be turned entirely off, is caused by a worn-out washer or Fuller ball, depending on the type of faucet. (See Figs. 2 and 3.)

Is there more than one type of washbasin faucet in general use?

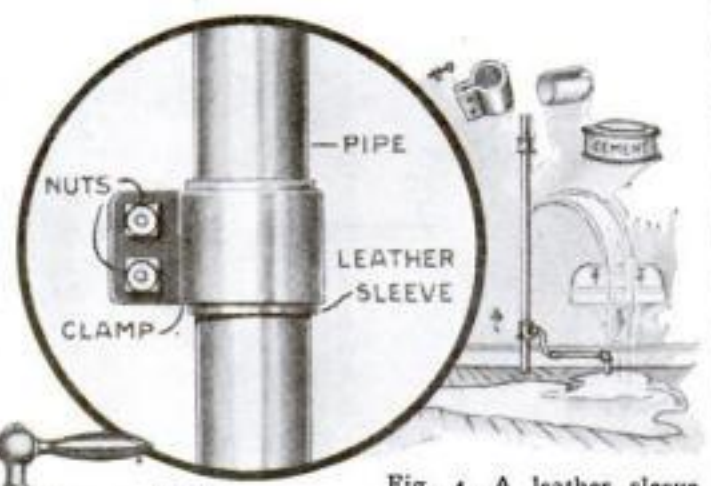


Fig. 4. A leather sleeve held in place by a metal band may be used to stop a small water-pipe leak.

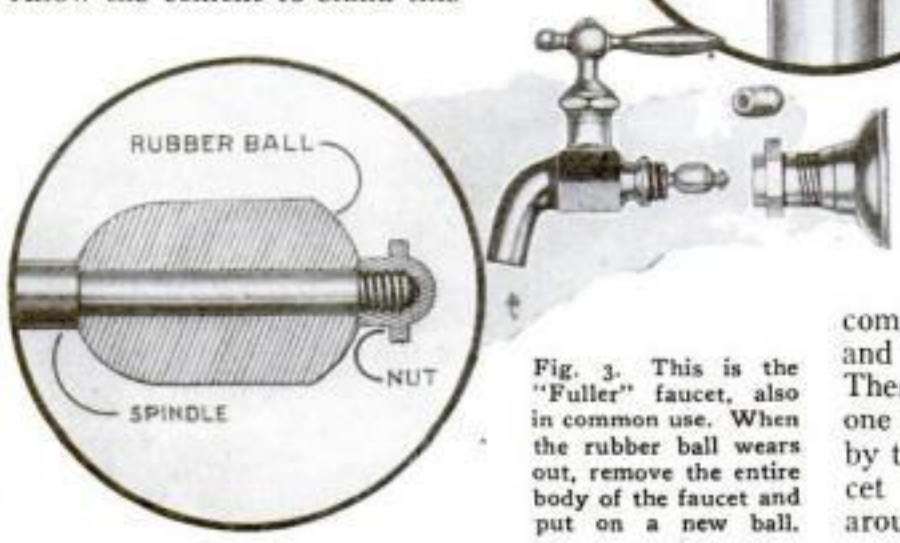


Fig. 3. This is the "Fuller" faucet, also in common use. When the rubber ball wears out, remove the entire body of the faucet and put on a new ball.

Yes, faucets may be divided into two general classifications—compression faucets (Fig. 2) and Fuller faucets (Fig. 3). These can be distinguished one from the other externally by the fact that a Fuller faucet handle may be turned around and around, while the

handle on a compression faucet will come to a stop after several turns are made.

How is the worn-out washer in a compression faucet replaced?

First, shut off the water supply, either at the main valve or at an intermediate one placed between the supply and the faucet in question. Next turn the handle of the faucet to the open position to release any pressure that may have accumulated in the pipe. To get at the washer in a compression faucet, we must remove the packing cap and stem as shown in Fig. 2. Use a rag to protect the polished metal from being damaged by the wrench jaws. This done, remove the screw that holds the washer and put a new compression washer in place. If the stem is recessed, as shown in the illustration, be sure that the new washer fits in snugly, but do not force it. If the end of the stem has no recess, the washer should not be so large as to extend beyond the metal of the stem. If no new washers are on hand, it is often possible to use the old washer by reversing it, if it is not too badly worn. Finally, replace the stem and packing cap and draw the cap up tight with a wrench. When replacing a worn washer, it is always well to inspect the packing in the packing cap, replacing it if it shows signs of wear.

Assortments of washers and extra screws are sold in convenient packages at hardware stores and often in five and ten cent stores.

What is the procedure in replacing a Fuller ball?

The Fuller type of faucet is shown in Fig 3. Shut off the water supply and open the faucet to relieve any pressure that may exist. In this type of faucet the entire body must be removed to get at the Fuller ball. Apply a monkey wrench to the hexagonal portion of the body, and, holding the base from turning with another wrench, unscrew the faucet. If the Fuller ball has become enlarged through use, it may stick, but it can be easily dug out with a thin knife, awl, or similar tool. Remove the nut at the end of the Fuller ball stem and replace the old ball with a new one, the rounded portion of the ball being placed against the valve seat. Open and close the faucet several times to make sure that it is working perfectly before screwing the faucet back on the base. If the faucet is of the type that has an adjustable ball stem, the seating qualities of the ball may be improved by shortening the stem.

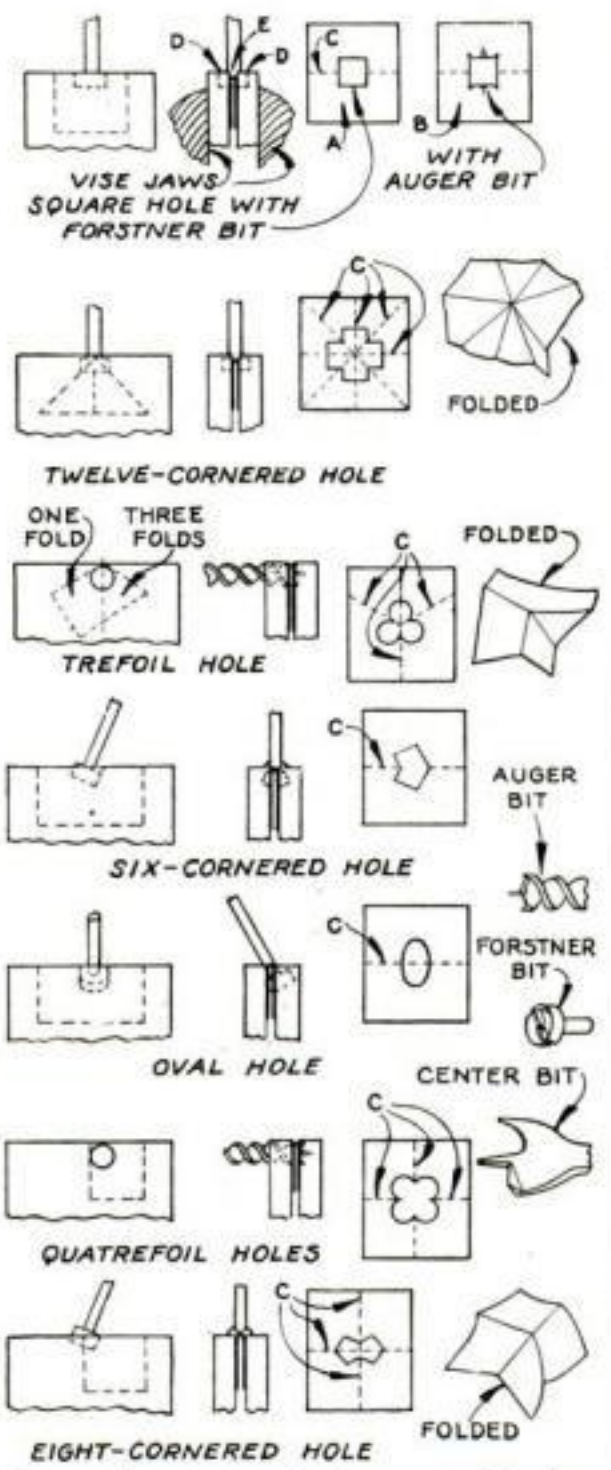
Should the amateur attempt to repair small leaks in water pipes?

Small holes or cracks in water pipes can be repaired by the application of the metal band and split leather sleeve shown in Fig. 4. First, press some boiler cement into the leak. The inside surface of the split leather sleeve, which should be slightly wider than the metal band, is also coated with the cement and is slipped over the leak. The metal band is then placed over the sleeve and the two bolts tightened. The metal band can be cut from a section of old roof gutter or any scrap sheet metal, or clamps can be purchased ready-made for this purpose.

HOW TO DO TRICKS WITH A BRACE AND BIT

THE idea that square or other angular or oval shaped holes can be bored with an ordinary round bit seems at first thought to be preposterous, but it is entirely possible. The trick is a good one for a home workshop enthusiast to display for the entertainment of his friends when showing them his shop equipment.

The tools needed are a bit brace and either a Forstner type bit, which bores a nearly perfect square hole as at *A*, or an auger bit, which bores a hole like that at



These diagrams reveal the secret of boring odd shaped holes in paper with a round bit.

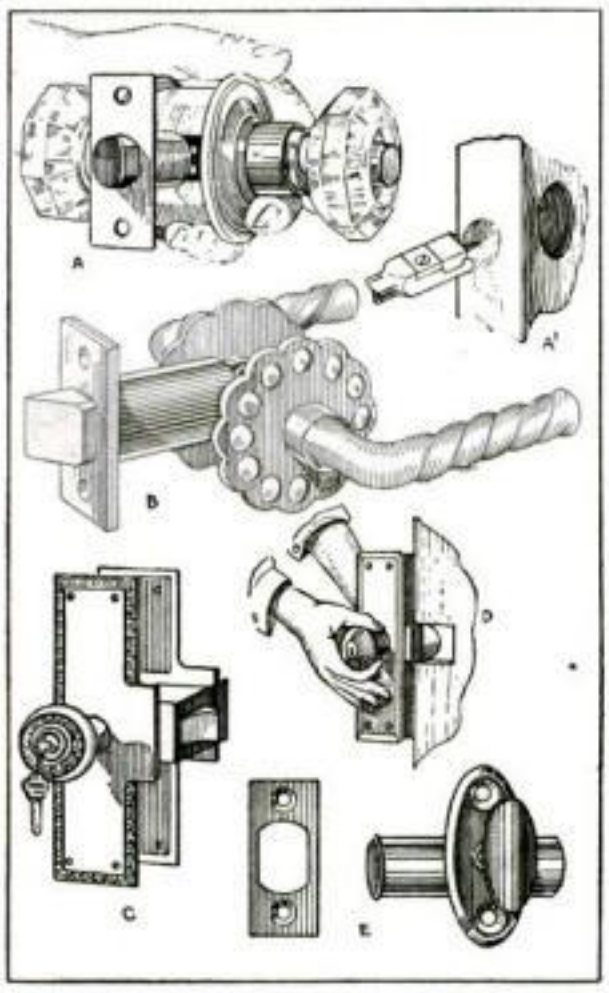
B. To make the square hole, fold a piece of paper about 4 or 5 in. square on the center line, as at *C*. Place the folded edge between two pieces of soft wood *D*, grip the whole firmly in a vise, and use the bit as suggested at *E*. Remove the paper, lay it flat, and the resulting hole will appear.

The remaining sketches show how the shape of the hole is determined by the different methods of folding the paper and placing it between the pieces of wood and holding the bit. Note that the auger bit is used in boring the trefoil and quatrefoil holes. An almost unlimited variety of holes may be bored by applying the same principle.—CHARLES A. KING.

NEW DOOR LOCKS THAT ARE EASY TO INSTALL

THE need of a high degree of woodworking skill to do a good job of fitting the usual type of mortise door lock has long been realized, but it is only recently that these drawbacks have been squarely faced and an attempt made to solve the problem. Now any home worker who shrinks from fitting a mortise lock yet does not want to use a clumsy and cheaply made rim or surface lock can find on the shelves of any well-stocked hardware store locks of the type illustrated, or they can be easily obtained if not in stock. These locks can be installed in from one quarter to one half the time usually required to fit an ordinary lock.

To fit the style of lock shown at *A* requires only the boring of two holes as



No mortising or difficult fitting is required in applying these labor-saving door locks.

at A^1. Locks of this type are reversible and made to suit every conceivable purpose and for any thickness of door from 1⅜ to 2½ in. There are styles that may be locked or unlocked from either the inside or outside as desired, or from both sides. At *B* is shown one of a decorative assortment of handles or pulls which may be fitted to these locks.

At *C* is illustrated a unit lock, which may be installed with even less skill and time upon any door not less than 1⅜ in. thick. It is necessary only to cut a piece from the edge of the door as at *D*, slip the lock in place, and drive the screws in the faceplates. This lock is not reversible, but is made for either right- or left-hand doors.

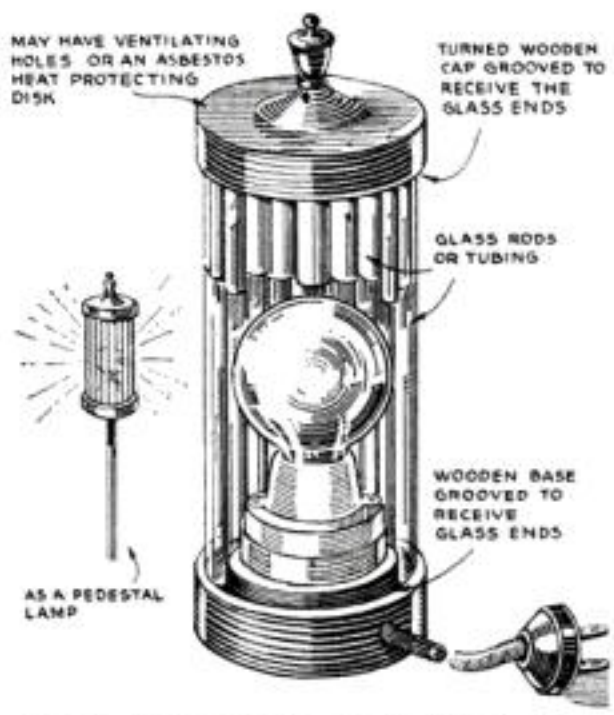
The dead bolt shown at *E* may be easily fitted to cupboard or closet doors not less than 1 in. thick and will give excellent service, although it can be operated only from one side. It is made in sizes to fit doors of all the dimensions and weights commonly used.—DAVID WEBSTER.

NOVEL LAMP SHEDS LIGHT THROUGH GLASS RODS

IN THIS unusual lamp the light is diffused with a pleasant softness through a layer of glass rods or tubes set side by side and touching each other. They are held in grooves turned in the two disks of wood which form the base and cap.

The tubing or rods can be purchased from chemical apparatus dealers in various lengths and diameters. Tubing ¼ in. in inside diameter will produce a decorative effect, and it can be easily cut to the desired length by making a scratch with a file and breaking it while holding it between the thumbs and forefingers.

The base and cap obviously can be made as ornamental as desired. It is well to provide a turned decoration of some kind for the cap, even if the base is left perfectly plain. The grooves should be designed to receive the tubes or rods without any play. A small amount of litharge and glycerin paste in the lower groove will then hold the glass securely, and the upper end of the rods or tubes may be cemented together. The cap itself should, however, be free to lift off for replacing the bulb when necessary.



Sketch of the completed lamp with the glass rods partly broken away to reveal the bulb.

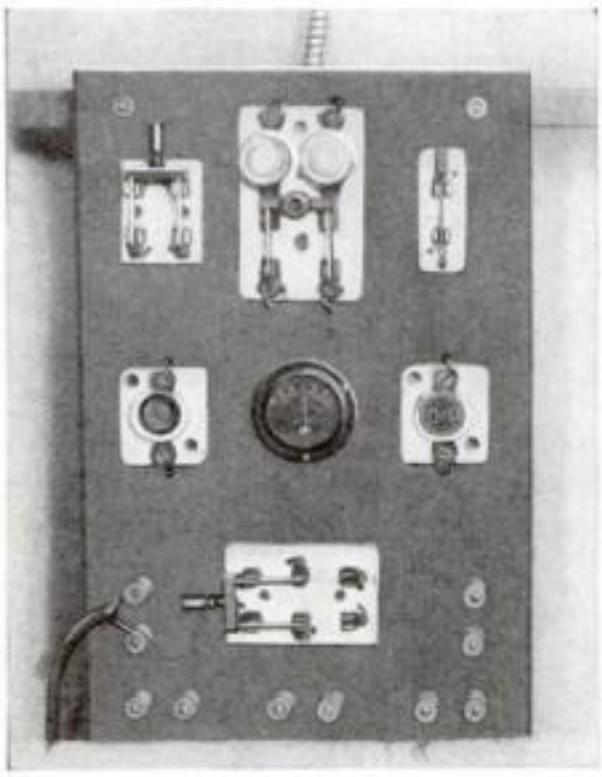
Before the lamp is assembled, a sign-base socket should be placed in the center of the lower disk, and the wiring completed. It is also desirable to provide a few holes for ventilation; and if the lamp is relatively small, asbestos paper or a disk of sheet metal should be attached to the underside of the cap to prevent scorching.

The lamp may be mounted upon a pedestal or used as a radio lamp. In the latter case a layer of felt should be glued to the underside of the bottom disk to prevent scratching the surface upon which it rests.—R. W.

AN EXCELLENT rubber cement can be made by dissolving pieces of old rubber in carbon bisulfide. This is brushed on the rubber parts to be joined, and a hot iron is applied to the joint. As in using all rubber cements, the utmost care must be taken to see that the joint is clean.—C. D.

A SWITCHBOARD FOR EXPERIMENTERS

THIS experimenter's switchboard will be found to meet almost every requirement of the home workshop and laboratory. Many tests and checks with 110-volt current can be made with it; and as it is also wired for direct current at 6

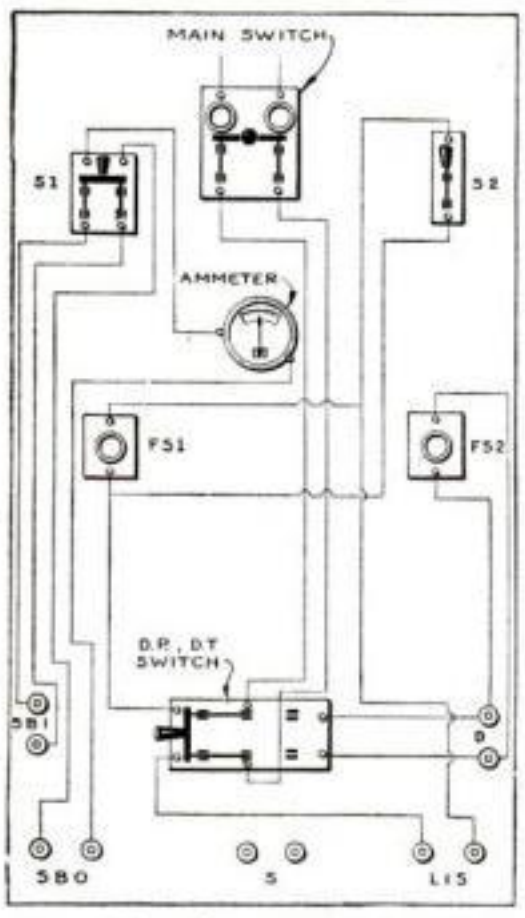


This conveniently arranged switchboard saves time in making test hook-ups of many kinds.

volts, experiments in electrolysis and electroplating are easily carried out.

The switchboard preferably should be of asbestos, slate, or other insulating material. All connections at the rear of the board are made with rubber-covered wire.

A main switch, fused, is placed at the top, and connections are taken from this and run directly to the blades of the double-point, double-throw switch at the bottom. When this bottom switch is in the left position, current can be obtained from the binding posts marked *LIS* and



The wiring diagram. All the wires, of course, are run behind the panel.

there will be a lamp in series, the lamp being in socket *FS1*. However, the single-point, single-throw switch marked *S2* must be open to have this lamp in series for connections at *LIS*. If switch *S2* is closed, the full current of the supply lines (that entering main switch) will be had at *LIS*.

With the lower D.P., D.T. switch thrown to the right, the supply lines are connected directly to binding posts *D*. Socket *FS2* is a receptacle for an ordinary screw-in plug. Therefore, when the D.P., D.T. switch is in the "right" position, devices such as an electric iron, vacuum cleaner, or toy transformer can be plugged directly into this receptacle for testing and operating.

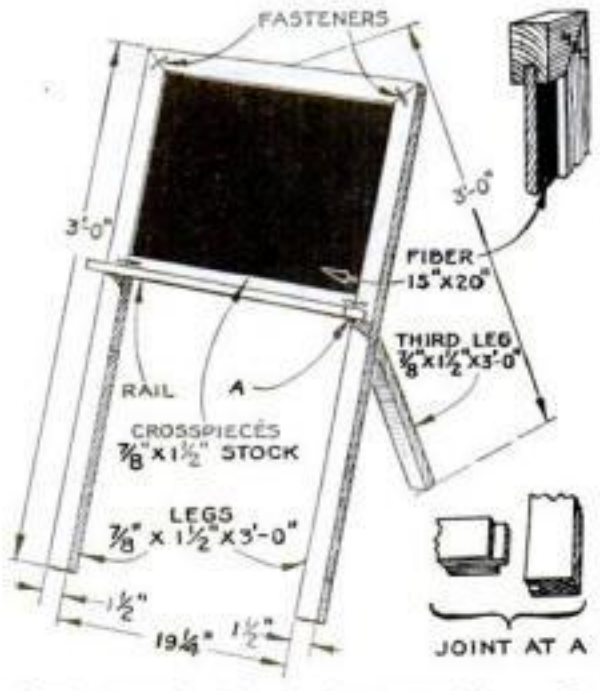
A storage battery connected to binding posts *SB1* will yield its current to the output binding posts *SBO* by means of the D.P., S.T. switch *S1*. The ammeter, of the automobile dashboard type, will be in series with this line, to show the load taken out. Binding posts *S* are merely for convenience in making special test hook-ups.—R. B. W.

AN EASY WAY TO MAKE A TOY BLACKBOARD

BY USING a few waste lengths of flooring and a small piece of fiber wall board, the home workshop enthusiast may, within an hour, construct an excellent toy blackboard.

Begin by ripping the two legs 1½ in. wide along the grooved edge of the flooring. These pieces should be 36 in. long or longer, depending on the height of the child. Two more pieces 1½ in. wide and also containing the groove are next ripped 23 in. long to serve as the cross members. Cut another piece of flooring the same length as the legs and remove the tongue with a plane; this piece will serve as the rear support. Nail a piece of flooring, tongue and groove removed, along the bottom of the frame for a chalk rail.

Sandpaper the wooden parts and cover with two coats of colored lacquer. Give the fiber board a coat of shellac or glue size and allow it to dry before applying the final coats of blackboard slating or dull black paint.—CHARLES M. RICE.



A playroom blackboard, the grooved frame of which is made from waste lengths of flooring.

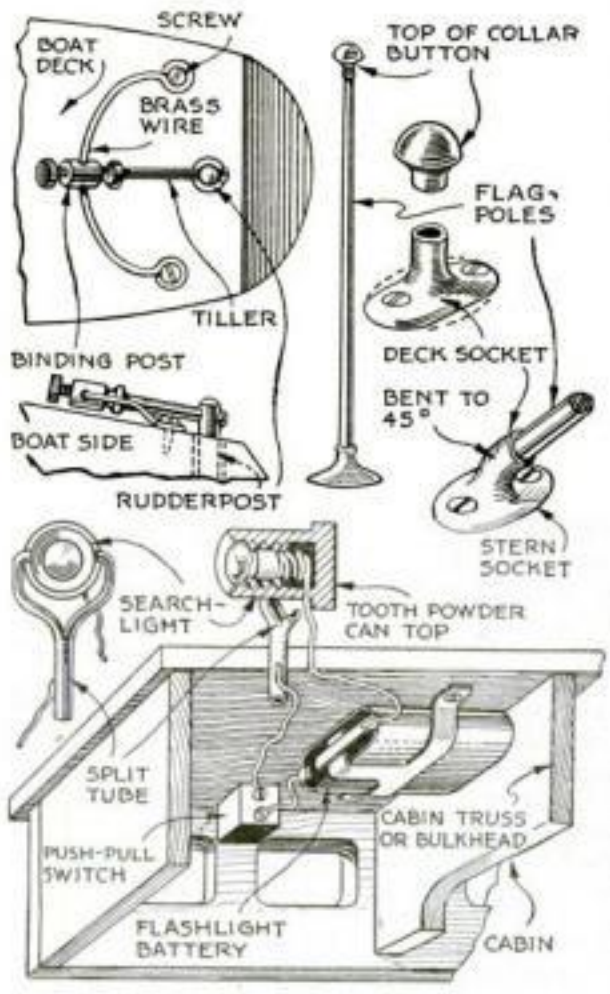
OUR BLUEPRINTS HELPED BUILD THIS MODEL

A well-finished, shipshape motorboat model built from our Blueprints Nos. 63 and 64.

THE 29-in. model motorboat cruiser illustrated above was built by Karl J. Burg, of Clinton, Iowa, with the aid of POPULAR SCIENCE MONTHLY Blueprints Nos. 63 and 64 (see the list on page 119). In sending the photograph, he wrote:

"Your blueprint service is excellent. I am filing all my issues of POPULAR SCIENCE MONTHLY and have from 1922 to the present date with only about three issues missing, and these I wish to obtain if possible."

He also sent a sheet of sketches showing simple methods he devised for constructing various details of the model. These ideas are illustrated in the accompanying drawings, which model makers will find to be self-explanatory.



Ingenious ways in which odds and ends can be used in constructing a model motorboat.

ORNAMENTS made of bronze can be cleaned by washing them with laundry soap or soap powder used with plenty of water. When the surface is dry, apply liquid furniture wax or a mixture of yellow wax dissolved in spirits of turpentine. Rub this on with a soft wool or linen cloth.

PHIL COOK MIKES HIS WHOLE SHOW AT ONCE

(Continued from page 59)

sical instruments, including the piano, the violin, and the saxophone for his "actors," and sings gay little ditties in comment on the news of the day.

The other evening I visited National Broadcasting Company headquarters, New York, to *see* Phil broadcast his one-man show. Softly strumming a "tiple," a cross between a ukulele and a guitar, he sat upon a low stool before a microphone and a music stand in one of the small studios. Blond, blue-eyed, six feet tall, broad-shouldered, he looked like an all-American halfback ready to entertain his classmates at a college smoker.

SEVEN-THIRTY sharp. Grinning from ear to ear, Cook began his introductory song. In the fifteen minutes that followed, I witnessed a phenomenon the like of which I have never seen. With each character he took, Phil completely changed his voice without a moment's pause for transition, switching the quality back and forth in the dialogue like a juggler keeping several balls in the air at once. This was done without the slightest show of effort. And each time his voice changed, his face assumed an entirely different expression. It was evident that he actually "lived" the little people of his sketch.

Though reading his material from a manuscript on the music stand, he succeeded in creating the illusion of improvising it on the spot. Through it all, he managed to keep an eye on the man at the mixing panel in the control room, separated from the studio by a window. He afterward explained to me that he did this to watch the control man's reactions.

"Those boys are pretty hard-boiled," he said. "They have heard the best. If that lad's upper lip as much as curls, I know there is a roar of laughter 'on the outside'."

During the broadcast, Phil continually shifted his position on the stool. Sometimes he was only an inch or two from the microphone. Then again, he moved to a distance of six, eight, ten inches and even a foot. He never exactly faced the microphone, which stood to the right of his face. In speaking certain lines, he turned his head toward it; at other times, he turned his head away.

Aside from the actual changes in vocal quality and dialect, these slight motions, I discovered, really constitute the secret of Cook's amazing technique. Effortless and spontaneous though they sound when coming from your loudspeaker, these little skits are the result of an enormous amount of hard work, experience, skill, and constant study.

For years Cook has studied the matter of microphone values and reduced it to a science. His own voice is husky in quality and low at all times. He knows exactly how to manipulate it so that, on the air, it will sound now like a booming bass, then like the childish falsetto of a ventriloquist's dummy, the throaty drawl of a Southerner, the wheezy, nasal voice of an old farmer, the high-pitched giggle of a negro mammy.

Here, in Cook's own words, is how he does it:

"To project Eddie, the hard, wise-cracking boy from the city," he told me, "I talk out of the side of my mouth, a bit nasal and high-pitched. To get him on the air properly, I turn my head away from the microphone and keep a distance of eight inches.

"For Abner, the seemingly stupid but really sensible country boy, I assume a slow, very throaty drawl. *(Continued on page 141)*

PHIL COOK MIKES HIS WHOLE SHOW AT ONCE

(Continued from page 140)

His lines I speak six inches away from the mike. 'Pop,' his father, has less voice, and for him, too, I take a distance of six inches.

"When I 'play' John, the old station agent, I draw both upper and lower lip over my teeth and talk in a very soft, throaty voice. The drawn lips produce the whistling and wheezy effect. Two inches from the mike is all I allow for him.

"Hemmingsway, the Englishman, also is very soft and a bit adenoidal. For him I speak as closely to the mike as I do for old John. The Irish voice is thick and 'breathy.' To produce this, I make a double chin. Five inches, I find, is the proper distance for Dad O'Brien.

"As for the morning characters, one of the black-face boys speaks in a slow, forced bass. He is very difficult, and must be projected from two to three inches from the microphone. The other colored lad has a high, nasal, rasping voice. Ten inches for him. Tony, the Italian, excited, loud, and boisterous, talks at a distance of eight or nine inches away from the mike.

"The imitation of the ventriloquist's dummies, on the air, is done in falsetto with head away from the mike, at a distance of a foot. The same goes for the negro mammy. She, being a woman, speaks in a bit softer falsetto."

Phil is on the air for fifteen minutes twice a day, at eight o'clock in the morning and at seven-thirty at night. At nine in the morning, he repeats the eight o'clock broadcast for the benefit of the Middle West and the Rocky Mountain section. But these forty-five minutes of his work which you and I enjoy entail nineteen hours of labor on his part! He writes every word of his material and composes his own tunes. Here is a typical Phil Cook day:

Rises at six A. M. Gets the morning paper at six twenty A. M. and selects three news items of national interest. Writes ditties about them and inserts these in the morning "show," written the night before. This is finished at seven A. M. Drinks a cup of coffee and walks to studio, which is reached at seven-thirty. Prepares for his act. Goes on air at eight. Finished at eight-fifteen. Has the rest of his breakfast. Returns to studio at eight-forty-five. Goes on air again at nine o'clock. Finished at nine-fifteen.

ATTENDS to personal affairs, correspondence, conferences, and the like, and tries to get in one hour's nap between nine-fifteen and noon. After lunch, writes the evening show. This takes at least five hours and is finished about five-thirty P. M. Eats light dinner. Walks to studio, which is reached at seven o'clock. Prepares for evening act. Goes on air at seven-thirty P. M. Finished at seven-forty-five. Goes home and writes morning show, which is completed about one A. M.

Hard work and—lonely! Phil does his heavy work and his light sleeping and eating in a New York City hotel room. His family, wife and baby daughter, live at his real home at Avon, on the New Jersey coast. He sees them one day each week, on Sundays.

But there are compensations. Cook's salary is said to be $50,000 a year. And he has the satisfaction of knowing that his shows are broadcast over the largest network used for any "single" act—thirty-five stations in the morning and thirty-seven in the evening. Then, too, many listeners write him letters, telling him how much they enjoy his work. In August, he received more than 10,000 letters, the record mail for any solo performer on the air.

WE STILL LIVE IN LAST ICE AGE

(Continued from page 58)

And what of this country? Many series of varves have been measured here. Ernst Antevs, one of De Geer's assistants, found, for example, that the ice took 4,300 years to retreat 185 miles up the Connecticut valley from Hartford, Conn., to St. Johnsbury, Vt.

But these American findings as yet have not been tied up positively with modern chronology. In other words, geologists now know how long it took the ice to retreat here, but they have not determined when it happened. According to De Geer, there are many points of striking similarity between the varve sequences in Sweden and those found in America and elsewhere. Hence he believes it possible to apply his Swedish time scale to the dating of Ice Age events in countries far from Scandinavia.

OTHER geologists do not share this view. Varves, like the animal rings of trees, register past weather from year to year; the thicker deposits were formed in relatively warm years, and the thinner deposits in the cooler years. De Geer's Swedish "calendar" would be useful here and in other distant countries only if there had been simultaneous fluctuations in the weather, year by year, during long periods of time in regions thousands of miles apart.

While the time of the so-called "end" of the last Ice Age has been advanced considerably as a result of the recent discoveries, the time of its beginning also has been brought forward. Although there still is a good deal of uncertainty about this date, an estimate of from 600,000 to 700,000 years ago now seems most plausible.

This latest invasion of ice left its marks all over the landscape of northwestern Europe and northeastern America. The mighty glaciers, pushing down from the north, planed off the tops of hills and mountains and gouged broad, U-shaped valleys between them. They brought from afar rocky and earthy debris known as "drift."

By filling former valleys, this drift built up the level prairies of our Middle West. Here and there, by scooping up the ground below them or by dumping material from above, they formed new hills, such as the "drumlins"—the long, oval hills about Boston, Mass.—and the chains of "moraines" stretching across New Jersey.

The moraines were formed from the accumulations of stones and earthy matter the glaciers carried upon their surface. In their basal parts they carried rock débris.

At the beginning of the Ice Age, the great ice sheets gradually spread from certain centers in high latitudes into lower latitudes, and from high mountains, such as the Alps, into the surrounding plains, until at length, after scores of thousands of years, a warmer climate set in. The advance then gave way to an equally slow retreat, and it is possible, though not certain, that all the great glaciers on the globe were melted away. Later came another gradual advance and another retreat.

IN North America, there is evidence of five large-scale movements of this sort in each direction, and four have been traced in the Alps. These, however, should not be confused with Ice Ages. The advances occurred during periods when the climate was relatively cold, and the retreats when it was comparatively warm. The cold periods now are called "glacial periods," and the relatively warm ones "interglacial" periods.

It is in one of these interglacial periods that geologists believe we now are living. From this it appears that mankind must wait many thousands of years, at least, for the real end of the Ice Age.

MODEL YOUR HOME

(Continued from page 79)

and I have found that women like prettily papered walls. An all log or slab interior would not be suitable for a bedroom. It would not match dainty counterpanes, toilet articles, and other refinements of the sleeping chamber.

This does not mean, however, that wood panels, smoothly finished and with the grain brought out in an attractive manner, cannot be made as alluring as other mediums. In fact I know of one woman who has a hemlock cream bedroom.

In this connection it is interesting to note that all over America there is a decided revival of the use of wood in interior finish, even if the exterior is of brick or stone. By proper staining and finishing, wood can be given a wide variety of attractive finishes in buff, gold, silver gray, and certain shades of green.

YOU probably have noted the lack of reference to any plastering. Plaster has its uses, of course, but we prefer wood or gypsum board because it has no tendency to crack and is not easily marred by furniture.

The absence of plaster means that plasterers and lathers are eliminated from the job while the house is being built. A minimum of artisans are at the building scene, as virtually all products come to the job ready for the carpenters. Sash and doors are bought already made, of course, except such special creations as the front door of our house.

The result is that the entire work of building can be accomplished in eight or nine weeks, as compared with the three to six months ordinarily required.

Our new home is warm. I am certain I could take the house and set it down in the coldest part of North Dakota without facing the need for any additional heating equipment.

A hot air furnace, with ventilating fan, is the main heating unit. In addition all rooms have power plugs installed for electric stoves. This means that an electric heater using up to the same power as an electric range can spread its glow at the turn of a switch. Fortunately, we are located where the cost of electric current is reasonable. Obviously, such a system of supplementary heat would be impractical in sections where electric power costs from seven to twelve cents a kilowatt hour.

HOW much did our home cost? The total was $12,000, not including the land. As the house contains 36,000 cubic feet, this was a cost of thirty-three and one third cents a cubic foot, a reasonable figure for such heavy construction.

I have designed homes of a similar type on a simplified scale using lighter timbers and having five rooms that were built for $3,500.

In this connection I might suggest that you consult and use a professional architect. It pays to employ one, economically and architecturally. You wouldn't think of trying to make a suit of clothes without employing a tailor or a pair of shoes without a shoemaker. The architect is equally indispensable in house building.

The very latest thing in house building is to have a small model, about doll's house size, built before you finally O. K. the plans. This practice is becoming very common on the Pacific Coast and has much to recommend it, especially to people who have difficulty in visualizing what a house will be like from blueprints or drawings. Such changes in the plans as you deem necessary can be made at this stage in the proceedings at a minimum of expense.

WHAT TO KNOW ABOUT ANTIFREEZE

(Continued from page 86)

the dirt. It's too far gone to fix properly."

"I'll be hanged if I'll listen to any more of them windy salesmen," snorted Backson disgustedly. "What's in that antifreeze, acid or something?"

"It's just a salt solution," Gus replied. "Not ordinary table salt—anybody would have more sense than to use that, but another kind of salt that isn't near so corrosive as table salt. Any kind of a salt solution is bound to be bad. It makes the radiator and cylinder block, which are of different kinds of metal, act like an electric battery. Either the inside walls of the cylinder jacket or the inside of the radiator, sometimes both, are eaten away."

"All right," said Backson with a rasping sigh, "I'm stuck for a new radiator. Now I suppose I'll have to go back to alcohol and have the car smelling like a bootlegger's bus every warm spell. I thought I had it fixed so I wouldn't spend all winter worrying whether there was enough antifreeze in the radiator."

GUS laughed. "Alcohol won't eat out the radiator at any rate, and it's relatively cheap, too. The big trouble with alcohol is that it evaporates like fog under a strong sun if you run the motor just as hot in winter as you do in summer. And if you don't run the motor that warm you're piling up trouble from crank case dilution, poor lubrication, and so on."

"Sort of between the devil and the deep blue sea, with alcohol, aren't you?" Backson chuckled. "Isn't there any way to use alcohol without all that trouble?"

"The only way I know of that really works," said Gus as he prepared to clean out the cylinder block, "is to fit the radiator cap air-tight, then run a nice long extension on the overflow pipe into a can fastened somewhere under the chassis so it'll stay cool. Make sure that the pipe sticks down into the can almost to the bottom.

"Then when the alcohol boils off it'll condense in the long pipe and run into the can. When the motor cools off after a run, the alcohol vapor above the solution in the radiator turns into liquid and that makes a vacuum so the air pressure pushes the alcohol in the can back up the pipe into the radiator again."

"Sounds too complicated to me," Backson wheezed.

"Most people would think so," Gus smiled. "It's a good system, though, if it's installed right. If you're worrying about the alcohol evaporating, why don't you use something that doesn't evaporate, say glycerin or ethylene glycol?"

"Nix!" snorted Backson. "The hotel business isn't so hot right now and besides, my grandmother was Scotch. Every time I think about forking over a five spot just for antifreeze, I get a cramp in the pocketbook."

"HUH!" Gus growled. "Maybe that kind of a cramp is better'n the shriveling it's going to get from this radiator job.

"Besides," Gus continued, "if you're going to do much driving in winter, alcohol isn't cheap in the end. One filling of glycerin or ethylene glycol lasts all winter no matter how much you drive or how many hot spells there are. On top of that there's nothing to stop you from draining off the solution in the spring and using it again next winter and the winters after that for as long as you want. When you drain it out the solution will be dirty, of course, but the dirt will settle out during the summer and by the following fall it will be just as good as ever."

"Sounds like some of them million dollar profit oil prospectuses," Backson jeered. "How about leaks? There's always a leak somewhere and by spring there won't be any solution left to drain off."

"But why have a leaky cooling system?" Gus argued. "Leaks are a sign of sloppy work. The cooling system ought to be as tight as a drum. It's just a matter of getting the hose connections tight, the cylinder head gasket right, and so on."

"How about the pump? Mine always leaks around the shaft. I'll bet you a good smoke you can't make it stop for more than a day or so."

WITHOUT replying Gus set to work to remove the pump. "Here you are, Jim," he said as he pulled out the pump shaft and held it up to the light. "See how it's all rough and scored? You can't pack a pump shaft like that so it won't leak. Let me put in a new shaft and promise me you won't forget to grease it and I'll guarantee that it won't leak more'n two drops all winter."

"Maybe I'll try it if you're as sure as all that," Backson finally agreed.

"What you've got to do," Gus when on, "is to kind of sew up the cooling system for the winter. Get every joint so it doesn't leak and then fix it so's nobody can disturb things. That means fit the filler cap so you can fasten it closed. Then the bird in the filling station can't upset things by filling the radiator solution with water every time you get gas.

"Once you've filled the radiator with the proper solution of glycerin and water or ethylene glycol and water to within a couple inches of the top, you don't want to add any water except to replace what evaporates. If you go filling the radiator so it overflows every now and then, you'll soon lose all the antifreeze out the overflow pipe. That's because the cold solution doesn't take up as much space as it does after it gets hot from running. Also I'm going to wire the drain cock in the closed position, so that there'll be no danger of its being opened accidentally and the solution draining away."

"How much evaporation will there be?" Backson asked.

"If you use your car for only short trips, sort of taxi service, there won't be enough water evaporation to bother about all winter. If you go on long trips, stop here once a month and we'll check the level and add water if it's needed. Only the water evaporates, anyhow.

"NOW about keeping the motor warm enough. If you have a dash type thermometer it's a cinch. Just cover up enough of the bottom of the radiator to make the thermometer read the same as in summer. If you haven't any thermometer, cover up the lower third. That'll average about right in this climate."

"What do you mean by dash thermometer?" questioned Backson. "Isn't that thermometer on the radiator cap good enough?"

"I should say not!" replied Gus emphatically. "That thermometer won't come within anywhere from twenty to fifty degrees of the actual water temperature on a real cold day. It's only good as a warning signal to show when the water boils. Trouble is, the cold air streaming past when the car is moving makes it read too low."

"I'm sold," Backson wheezed. "Fix it up when you get the new radiator and I'll go home and find me a nice can so I'll be all ready to drain out that solution next spring!"

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FLOPS OF FAMOUS INVENTORS

(Continued from page 61)

name so far as helicopters were concerned. His machine, the most successful helicopter to date, is on exhibition in the Smithsonian Institution in Washington. In 1923, it rose twenty-five feet vertically and moved 400 feet horizontally.

Another reason why inventions fail is that, though sound, they are impractical. Take, for example, Thomson's deodorizing machine for automobile fumes. In principle it might have worked, but it was so large and cumbersome that it would have necessitated doubling the usual size of motor cars. Maxim's steam cooker is another case in point. Mechanically, there was nothing whatever wrong with it, but it had all the complications of a full-fledged steam power plant, which most housewives are unwilling or unable to master.

THEN there is the question of marketing an invention. This may be impossible because the same thing already has been done as well or better by someone else, or because the article cannot be made cheaply enough. Ford's bed-tilting device was not a success because there were several satisfactory appliances of the same kind in existence. Maxim's game of skill struck a similar commercial snag. It was an elaboration of chess, which most devotees of the game consider sufficiently complicated as it is.

Many inventions, though impractical and unprofitable in themselves, often are the forerunners of extremely valuable apparatus. A classical instance is a phenomenon discovered by Edison in 1884 and known as the "Edison effect." It brought him no money and added little to his fame, but its principle was used by Fleming in his two electrode vacuum tube. Still, the discovery did not amount to much until De Forest added a third electrode and thus evolved the modern radio tube which is responsible for today's enormous radio development.

A number of prominent inventors have racked their brains in an effort to devise a practical hydraulic drive for automobiles. Elihu Thomson, as early as forty-one years ago, designed such an engine. It proved impracticable and this problem has not been solved yet, and perhaps it never will be.

In order not to be a "flop," an invention not only must do the work it is meant to do, and do it well, but it must perform its task better or more cheaply than anyone else's, or both. In addition it must be wanted by the public; that is to say, the people of the inventor's own day and generation. But it need not be an "important" or complicated machine.

VACUUM TUBES MAY DO TRANSFORMERS' WORK

NEW types of vacuum tubes may revolutionize the science of power transmission by making it possible to send direct current over existing lines in greater quantities and with less loss than alternating current, according to a recent prediction by O. H. Caldwell, a former member of the Federal Radio Commission. The first electric current ever used was direct, but it was soon abandoned for long distance transmission because it could not be changed from higher to lower voltages.

With alternating current, voltages are changed at necessary points along the line by transformers. These will not work with direct current, but the vacuum tube, long familiar to radio users, has removed this disadvantage and direct current may be "stepped" up or down.

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NEW SAFETY UNDER THE SEA

(Continued from page 41)

white with bubbles and foam. The bow disappeared, but the conning tower was still above the surface. Then with a rush the water foamed over it.

Unconsciously, I ducked my head and held my breath, as though making a dive beneath the surface. Then I began to breathe naturally and look around. Outside the portholes, long chains of bubbles, large as marbles, drifted by. They moved leisurely, then faster. The motors were speeding up.

The bubbles flashed past in silver lines now with an upward slant. We were going down. A coil of rope, wound about the superstructure, fluttered in the water as though blown by a breeze.

NEAR my face, at the top of the conning tower, a heavy iron hammer hung by a leather thong. In an emergency, that hammer is used to tap out messages in Morse code—one tap for a dot, two for a dash.

The color of the portholes altered, turned dark gray, deep blue, almost black, as we entered the twilight gloom of the undersea water. I climbed down into the electrically-lighted control room. In this space, about fifteen feet square, is packed a bewildering maze of levers, wheels, valves, and switches.

At the foot of the hatch, the helmsman steers his course by a gyro compass, an instrument unaffected by the steel of the hull. Beside him, another member of the crew governs the motors. At the opposite end of the room, before a bank of small valve wheels, a third man controls the compressed air that blows out the tanks.

Half a dozen huge levers, like those in the cab of a locomotive, stand upright beside the right wall, with two sailors ready to man them at an instant's notice. They open the big Kingston valves that let sea water into the ballast tanks.

Facing the other side of the room, two men grasp large wheels and keep their eyes on the depth gages in front of them. These men operate the bow and stern planes, either by the hand-turned wheels or by electrical connections. These planes lift or depress the nose of the great cigar-shaped hull. The bow planes determine the depth of a dive; those at the stern, the angle.

The men who handle the planes on a submarine have one of the most delicate jobs on board. These great metal flippers must move in perfect coördination. If the boat is sent down at too steep an angle, it may throw the propellers out of the water and race the engine, or strike the bottom.

When a submarine dives to great depths, it actually decreases in size. At 200 feet, an area on the hull the size of your hand has to withstand a pressure of more than a ton. Such tremendous weights crushing in from all sides on the steel hull compress it. The diameter of an S-type submarine, for example, is between one and two inches less at 200 feet than at the surface.

Lieut. W. N. Downes, for nine years in the submarine service, told me of being on a depth cruise where the floorboards of the battery compartment, which had been cut to the exact width of the room, bowed up as the sub passed 200 feet. When new undersea ships are tested, the amount of this compression is carefully measured. If it is too great, or if the boat fails to resume its normal size at the surface, it is rejected.

Such pressures are only one of the perils that menace the life of a submarine sailor. But the thing that he dreads most of all is a little tickling in his nose! This indicates that deadly chlorine gas is escaping from the batteries. This greenish-yellow vapor is produced by the electric current passing through salt water which has leaked into a cell.

In the center of the control room, Captain Ocker was walking around in circles, looking through the periscope, a pistonlike cylinder that disappeared through the ceiling. He was responsible for avoiding other craft during the cruise. The boat can descend to thirty-five feet before the periscope dips into the water.

Suddenly a sailor popped his head in at the control room door and shouted:

"Chlorine gas escaping from battery A!"

With a bloodcurdling scream, a fire siren went off somewhere in the hollow, echoing hull. My hair stood on end. Captain Ocker gave quick commands:

"Secure battery A! Close off forward battery compartment! Blow the tanks!"

The high-pitched wail of the siren continued. Forward, a steel door slammed with an echoing clang. Compressed air hissed, like the sound of the air brake on a standing train. The depth gage needles swung rapidly toward zero.

"On every training trip," Captain Ocker calmly explained, "we practice what has to be done in different emergencies. In the chlorine gas drill, we cut off the battery causing the trouble, close off the compartment to keep the fumes from spreading, and come to the surface to air out the boat."

We submerged again. With Chief Torpedoman A. L. Garren, a veteran who has seen service on ten submarines, I made a tour of the boat. In the cook's galley, in one corner of the aft battery compartment, I saw potatoes and pork chops sizzling on an electric range. Here coffee is always on tap. In every compartment on the boat, emergency rations—fourteen cans of pork and beans together with a can opener and ten gallons of fresh water—are stored in wall containers that have glass faces.

IN VARIOUS parts of the vessel, soda lime canisters are available for removing the carbon dioxide breathed into the air some twenty times a minute by members of the crew. Metal bottles of compressed oxygen, similar to the gas containers used at soda fountains, are also distributed about for use in an emergency.

Under an air-tight floor in the two battery compartments, ahead and behind the control room, are the 120 cells, sixty in each room. These giant batteries are almost as tall as a man and weigh a ton apiece. Special ventilating systems, Garren told me, discharge their fumes outside the boat when it is running at the surface. But underwater these gases enter the submarine.

Back of the aft battery compartment we entered the engine room, heavy with oil smoke, housing twin 450-horsepower Diesels. Behind it, the air filled with the acrid odor of chemicals, is the motor room with its two 215-horsepower electric power plants. A lathe, workbench, and grinding tools on board the sub allow emergency repairs to be made at sea. Under the engine room aft and beneath the torpedo room at the bow are the huge fuel tanks for the Diesels.

To preserve balance, the sea water is allowed to enter these tanks at the bottom as the oil is consumed. Floating on the water, the oil is drained off at the top. A small amount of brine in the fuel apparently makes no difference. But the lubricating oil must be kept free from salt water.

Beside the cook's galley, the wall was lined with gas masks, one specially fitted to each member of the crew of twenty-seven enlisted men and three officers. Stored at the ceiling of the motor room are life preservers and "artificial lungs." These latter safety devices have bags, strapped to the chest of the wearer, containing (Continued on page 149)

NEW SAFETY UNDER THE SEA

(Continued from page 148)

chemicals that purify the air breathed into them through rubber mouthpieces (P. S. M., Nov. '30, p. 40). On the mouthpiece a large rubber plate fits outside the lips and a smaller plate between the lips and teeth.

There is a dramatic and little-known story connected with that second smaller plate. Several years ago, when Lieut. C. B. Momsen, one of the inventors of the "lung," was experimenting with it at a depth of 100 feet, he nearly lost his life when he sneezed, dropped the mouthpiece, and only regained it with great difficulty. As a result, he added the second rubber plate to press against the nerve that controls sneezing under the upper lip and make such accidents impossible.

JUST as I reached the torpedo room, far at the bow of the *O-1*, there was a sudden jar, as though we had struck something. The crew back in the control room was holding torpedo practice. Instead of using the 2,200-pound torpedoes that lie in racks like blunt, red-and-yellow-nosed miniature submarines, the practice is carried on by letting water into the torpedo tubes and then firing it into the sea with compressed air.

In the early days of the submarine torpedo, it was an erratic and dangerous projectile. Once one passed through a target and, turning like a boomerang, headed back for the submarine that fired it. The undersea boat was going down in a "crash dive" at the time. The first the crew knew of the returning torpedo was when officers listening through "M-V" sets heard the whirr of the projectile passing directly overhead.

Such "M-V" sets for listening for other boats are part of the equipment of every submarine. From eight to twelve microphones are located at different places on the boat to pick up the faint underwater sounds of surface ships and other submersibles. They amplify the "rum-rum-rum" pulsations of a ship's propeller so it can be detected two miles away.

A "crash dive," mentioned a moment ago, is a sudden and steep descent made to avoid a collision. The usual submergence is termed a "running dive." I had a taste of a quick descent a few minutes after I returned to the control room.

"Collision in the torpedo room! Crash dive!" someone shouted. The floor rocked under my feet as the nose pointed down at a steep angle. The hands of the depth gages advanced to forty—forty-five—fifty. We touched nearly sixty feet before the boat leveled off and pointed its nose up in an equally steep ascent.

Zooming up at the end of our dive, the *O-1* burst out of the water like a bombshell.

WE had been down more than thirty minutes. Our eyes were beginning to smart from the fumes in the hold. Suddenly, we felt a sharp change of pressure on our eardrums. The air manifold had been thrown open before "cracking the hatch." We were running on the surface.

Captain Ocker climbed to the little bridge above the dripping hull and I followed. The Diesels went into action, shooting white clouds of smoke from the exhausts at the stern. We headed for home.

Riding steel boats under the sea is a commonplace experience to the men of New London. Practically every day of the year, the training subs leave the base at eight o'clock in the morning and one o'clock in the afternoon, almost with the regularity of buses. These O-boats, some more than ten years old, have traveled a million miles without a serious accident.

MY FORTY YEARS OF FLYING

(Continued from page 25)

hour "rubber cow" in 1905, he is reported to have said on landing: "I do not believe any greater feat of aerial navigation is likely."

At the close of the St. Louis Exposition, Paul Hawse, a showman, and I were returning from the American Derby at the Washington Park race track, Chicago, when Hawse pointed out the window of the elevated and said:

"See that field of sheep over there? That would be a good place to set up a merry-go-round and a Ferris wheel!"

That was the beginning of White City, the famous Chicago amusement park. I had charge of installing all the electric equipment. In one year I made $47,000, and I spent it all on dirgibles. The first of the fleet of fourteen airships, which I built at various times, was finished in the fall of 1905.

I CALLED it *The Eagle*. All of these early lumbering machines had high-sounding names like *The Arrow, The Comet, The Eagle*. And their top speeds were close to eighteen miles an hour! I remember that I used to advertise that I would "fly in any wind—up to twelve miles an hour."

The gas bag of *The Eagle* measured seventy feet in length and eighteen feet in diameter. The envelope was sewed together in squares, like a patchwork quilt, so a rip could not run farther than one square. I used the finest grade of Japanese silk, costing $1.25 a yard, and coated it with a varnish made by boiling down raw linseed oil and diluting it with high-grade naphtha. Afterwards the bag was talcumed to keep the silk from sticking. This first ship cost me about $7,000.

Under the bag hung a thirty-six-foot framework. Three slender spars of spruce were braced with crosspieces and wire, and they held the operator and the motor, a six-horsepower engine weighing fifty-six pounds which I designed myself. The propeller had four-foot blades made by stretching canvas across spruce strips. At the rear, a fishtail rudder steered the machine. I pointed the nose up or down by walking back and forth on the three-inch "planks" of the framework and I operated the rudder by means of two ropes which I held in my hands like reins.

We filled the bag with hydrogen in a big tent on a baseball field near the old Chicago Avenue Water Works. It was December 28 before the machine was finally in shape to fly. The newspaper men got tired of standing around in the snow waiting for us to try the machine. My manager told them the machine would surely fly on the twenty-eighth. It did. It flew for half an hour—just about the most exciting half hour in my whole life.

JUST before the start, the manager took off an extra thirty-pound sack of ballast without telling me. When I shouted: "Let go," the ship shot up like a rocket. It was after 4:30 P.M. then and almost dusk. I threw overboard the 200 feet of sash cord which formed the dragrope, but the airship was already too high for those on the ground to grasp it. The lights below got smaller and smaller. The motor was sputtering. I crept along the framework to adjust the carburetor, which had been affected by the rarefied atmosphere. The engine stopped altogether. We were still rising and the icy wind was drifting us across the city toward the open Lake Michigan which stretched for fifty miles to the east. Already we were above the heavy, snow-filled clouds; the lights were blotted out. *(Continued on page 151)*

MY FORTY YEARS OF FLYING

(Continued from page 150)

As we rose, the gas expanded. Above me, the silk was stretching taut, ready to burst. On modern blimps, a safety valve automatically lets out gas when the internal pressure nears the bursting point. On my first machine an appendix hung down from the bag, tied shut with a rope. When I wanted to let out gas, I had to untie the rope. My fingers were numb with the cold when I pulled myself up to the appendix, balancing myself on the top strip of the framework, 4,000 feet above Chicago.

The knot in the rope had frozen tight. I couldn't budge it. We were still rising. The bag was straining and bulging. A minute more and it might burst like a paper bag. In desperation, I began chewing on the knot. After what seemed hours, it came loose. The sudden rush of hydrogen struck me full in the face. Stunned, I fell to the framework, just able to cling to the wooden strips.

WE were falling now as fast as we had been rising before. I did not know whether we were still over Chicago or whether we had drifted out over the ice-choked waters of Lake Michigan. Then I saw the glare of the East Chicago roller mills reflected on the clouds ahead of me and I knew I was still over dry land.

Clinging to the framework with my feet, I warmed my hands in my pockets so I was able to tie up the appendix as we neared the ground. Lights were everywhere below me, now. They blinded me. The high Chimney of the Grand Crossing Tack Factory loomed up before me. The framework smashed into it, nearly jarring me off, then slid past and over the top of the factory. A great crowd had collected below. I called for them to grab the dragrope. Just then, when the worst seemed over, I met the greatest danger of all.

I was drifting low over the Lake Erie Railroad tracks. The crowd suddenly roared a warning. Around a curve raced an express train, its dazzling headlight lighting up the crowd, the snow-covered tracks, and the huge black bag hovering above. At the moment I was near the motor. I grabbed the battery and hurled it overboard. The ship bounded upward just in time.

It was so close to the train that I was blinded and choked by the smoke, and the dragrope actually slid over the tops of the last coaches of the express. Near Madison Avenue and Eighty-Second Street, people caught the dragrope and pulled me down. I let out the gas and carried the airship back to the ball park on a wagon. That was the first of nearly a thousand dirigible flights.

THE morning after this wild ride over Chicago roof tops, the papers evidently couldn't decide whether the airship or I deserved the credit. So they split it fifty-fifty by running big headlines: "Horace B. Eagle Thrills City."

After that flight, the airship fever hit Chicago. At one time there were seventeen people building flying machines in the community, but none of them got off the ground. In January, I made several other flights in the icy winds over the city, then packed up my airship and headed for New Orleans. There, at least, I should be able to keep my hands warm.

The *Eagle* arrived in time for the Mardi Gras. We caused a great sensation by pretending I had flown down from Chicago. We put up our tent at night and got the machine inside and began filling the bag without letting *(Continued on page 152)*

MY FORTY YEARS OF FLYING

(Continued from page 151)

anybody get near it. On billboards was printed "Wild Has Started," then "Wild Is on His Way!"

The next night we dressed in old clothes like a pair of roustabouts, hired a buggy, and went to one of the poorer sections of the city. We mingled with the people for a while and got acquainted. About nine o'clock, a helper on the outskirts of the town sent up two kites, one carrying a red lantern the other a green one. We saw them first and yelled:

"There's that airship! Somebody run and phone the papers!"

SOMEBODY did. The next morning, announcements that the Wild airship had been reported over that section of the city appeared in the papers and on the billboards in red letters, placed there in the early morning hours, was the announcement: "Wild is Here!" We threw open the doors of the tent and sure enough, there was the airship.

The only trouble was that when I gave my first exhibition, the rudder got tangled in telephone wires as I took off. When I tried again, the engine stopped. The third time, an assistant forgot to turn on the main gasoline feed line so the motor ran a couple of minutes and quit. When I landed this time, somebody in the crowd shouted:

"You say that thing flew down here. It can't even start."

"Well, it is a little hard to start," my manager admitted, "but once it gets going it can stay up for weeks."

Luckily, on the next attempt I got away and flew around for twenty minutes—and landed just before the gasoline supply gave out!

On those early exhibitions my flat rate was $1,500 guarantee and $1,000 for every flight of ten minutes or over. I used to have a watch where I could see it easily while I was in the air. When I had been up six minutes, I used to start holding my breath for fear the engine would give out. Dirigibles are a different proposition today from what they were then. A Zeppelin has circled the globe, and last year American blimps flew 132,000 miles and carried 6,000 passengers without an accident.

Little was known about aerial travel in 1905-6. Reporters sent in extravagant stories to their papers. One wrote that I came down after each flight, at an altitude of 1,000 feet, faint and weak from loss of blood due to the rarefied air at that tremendous height.

ANOTHER reported that I always had to chew gum while in the air or the flow of saliva stopped. He related how I had mislaid my gum before a flight over Kansas City and had come down with my tongue so swollen and parched that I couldn't speak a word for two days.

In 1905, when I flew over Chicago and dropped $250 worth of checks as a newspaper advertising stunt, it was stated that I had requested that the checks be printed on the thinnest possible tissue paper to reduce their weight!

On that stunt, I was billed as "the Flying Santa Claus" and the streets were packed with people who trailed after the airship ready to pounce on the checks. I flew low to see the scramble when I tossed them overboard.

While I was watching the fun, I almost ran into an apartment house. There was a woman looking out a fourth-story window. When the big gas bag sailed past within a few feet of her *(Continued on page 153)*

MY FORTY YEARS OF FLYING

(Continued from page 152)

she was so surprised she spilled a whole dishpan of water on the people in the street below.

In New York City, in the early days, a "rubber cow" ran smack into the side of a tall building. It bounced off and proceeded on its way unharmed!

A few weeks ago, at the National Air Races in Chicago, I met an old friend of the pioneer days, Victor Lougheed. Lougheed was the author of a famous early book on aviation called "Vehicles of the Air." We used to argue by the hour over the relative merits of dirigibles and airplanes. Once he wrote a long article for a magazine on "The Fallacy of the Dirigible." He must have bought a hundred copies of that issue, for every time I had an accident he would send me a marked copy.

I REMEMBER one of these occasions, when my motor stopped over Chicago and I began drifting toward the lake. I dropped the dragrope and a 240-pound woman sitting on a back porch on South State Street made fast to it with a death grip. The wind buffeted the airship and nearly shook me off the framework.

I shouted for her to let go. She braced herself determined to save me singlehanded whether I wanted to be saved or not. The tugging bag nearly pulled away the porch, but the determined lady hung on. Finally, I had to cut away part of the rope to get loose.

Then the ship came down in a back yard. A clothes pole poked a hole in the gas bag. I slapped my hat over the hole to keep in the gas and shouted for someone to run to the corner drugstore and get some adhesive tape. When this came, I pasted up the hole and got the machine up on the flat roof of a car barn near by. Nearly 70,000 people gathered, crowding the streets. A wagon-load of police clanged up to hold back the crowd.

In the midst of all this excitement, a Western Union messenger boy climbed up where I was and handed me a marked copy of "The Fallacy of the Dirigible." Lougheed had been in the neighborhood and had dashed home to get it. I found a nice red brick and looked over the edge of the car barn for Lougheed but I couldn't see him anywhere. I never did find out how he got that magazine there so quickly.

But last year I had back at him. When the *Graf Zeppelin* completed its round-the-world trip, I sent him the big black headlines in the New York papers and wrote above them: "The Fallacy of the Dirigible—Read 'Em and Weep."

Next Month: Capt. Wild will relate further adventures with these "Rubber Cows" of the early days and give inside facts about the great flights and flyers who wrote the early chapters of aerial history.

COLORS BEETLES LIKE

GREEN traps catch more beetles. So concludes the United States Department of Agriculture, which recently tried catching Japanese beetles with different colored traps.

The green traps caught one hundred beetles to every ninety-three caught in the brown, the nearest competitor. Other colors tried were red, blue, orange, white, indigo, black, and purple.

Four traps of each color were used in the tests and their position was changed each day. An unpainted trap caught only sixty-nine beetles to every one hundred caught in the green trap.

DYNAMITE HURLS DAM INTO PLACE

(Continued from page 26)

the power plant is in a gorge in a rocky section of the river. To complete a large masonry dam across this gorge, it was necessary to excavate a diverting canal, and turn the river into it at a time of low flow.

Because of the depth and velocity of the water, the usual method of putting in timber cribs and weighting them down with blocks of stone or concrete was found to be impracticable. It was then that James W. Rickey, chief hydraulic engineer of the Aluminum Company, suggested the novel procedure. His proposal, in brief, was this:

Build a large, heavy, reënforced concrete obelisk or tower of the proper length on a concrete pier at the edge of the river, at a convenient place upstream from the power dam. Mold one side of this obelisk into a jagged curve so as to fit, as nearly as possible, the bottom of the river. Blast away a small portion of the pier, and the tower, curved side down, will tip into the river and form a coffer dam.

The canal was excavated, and tunnels were built in the power dam with large gates capable of carrying 50,000 cubic feet of water a second and passing it under the power house.

Then Rickey and his staff made their designs and computations for the obelisk.

The obelisk was constructed on top of a concrete pier composed of two parts, one a massive supporting pier, the other a thin pier next to the river.

Twenty-five feet depth of water was left flowing through the old channel. This formed a cushion for the obelisk to fall upon.

When everything was in readiness for dropping the obelisk, holes in the thin pier were loaded with dynamite and it was blown away. Down came the giant "plug," throwing the water up from two to three hundred feet in every direction. But because of its great weight and the speed of its fall, the obelisk was not affected by the swift current of the river. Whole and sound, it dropped into place exactly like an oblong peg in an oblong hole.

RADIO NOW HAS TONE CONTROL

(Continued from page 85)

special features in the audio amplifier circuit of the set which will make the change without disturbing the volume.

As has already been mentioned, a tone control would be just another useless gadget on the front of the set if the performing artist, the broadcasting, the radio receiver, and the room in which the set was installed were perfect.

Granting the uselessness of tone control under such conditions, there still remain certain definite uses for it. It will serve to make screechy sopranos, raspy tenors, and blaring brass bands easier on the ears. It will reduce the effect of static but only at the cost of some loss in tone quality. In such cases it becomes a question as to whether it is better to cut out the static and suffer the accompanying loss in true tone quality, or to shut off the set and wait for a better night.

Engineers have agreed that true reproduction can only be had when the volume from the loudspeaker exactly equals the volume produced by the musicians in the studio. When the volume is reduced, the human ear, being less sensitive to the low notes, will no longer hear them in proper relation to the rest of the tone scale. The net effect, therefore, of reducing the high frequencies when the volume is low, may actually give the ear a better picture of the music being broadcast.

HOW ERRORS CRASH THE STOUTEST PLANES

(Continued from page 43)

interferes with the vacuum pocket above the lower wing, lessening its lift.

Since the speed with which the air flows past the wing determines its lift, the rate at which the plane travels through the air, and not its ground speed, is important. If a craft has sufficient lift to rise at fifty miles an hour, it must be traveling over the ground in a dead calm at that speed on the take-off run before it can get into the air.

If it is heading into a thirty-mile wind, it rises as soon as it has attained a speed of twenty miles an hour over the field, because the wind flows past the wings at thirty miles an hour to start with and the effect is the same when the plane is standing still as though it were running along the ground at thirty miles an hour.

HOWEVER, if the start is made *with* the wind, the speed of the plane through the air will be zero when it is moving along the field at thirty miles an hour and a speed over the ground of eighty miles an hour will be necessary to raise the plane.

Similarly, in landing, if the wind is from the rear, the machine touches the ground at high speed. Also, there is danger of a gust catching under the tail and causing the machine to nose down and crash while going full tilt.

One machine, during the National Air Races, crashed upside down at low altitude in a freak accident at the end of a fifty-mile race. Lieut. John De Shazo, crack Navy racer from the aircraft carrier *Lexington,* crossed the finish line right on the tail of another machine. At a height of barely a hundred feet, he put his Boeing fighter into a left roll and the machine dropped to the ground like a stone, carried downward by the backwash from the propeller of the machine ahead.

Even in ordinary flying, a plane rarely moves through a smooth medium. The atmosphere is not even. There are waves, up and down currents in the air, lifting and dropping the machine, upsetting its balance. The control surfaces—rudder and elevator at the rear and ailerons near the wing tips—permit the pilot to restore balance or to put the machine in any desired position.

An airplane is so designed that when it is in normal flying position the "center of pressure," an imaginary line from wing tip to wing tip marking the center of lift, and the "center of gravity," or of weight, come approximately in the same place. Usually, the center of gravity is placed slightly ahead of the center of pressure, so a tractor machine will nose down a little if left to itself.

THIS fact aided Kenneth "Red" Hunter, one of the four flying Hunter brothers who captured the world's refueling endurance record at Chicago last summer, to land a big four-passenger cabin monoplane near Davenport, Iowa, when the whole motor tore loose and fell to the ground. In October 1929, Hunter was up with three students at about 1,500 feet when one blade of the propeller broke and the uneven jerk of the other blade tore out the heavy engine. The sudden removal of this weight from the nose of the plane upset its balance. The tail dropped. Hunter shouted to the students and they scrambled up beside him, moving the center of weight away from the tail and allowing him to bring the ship down safely with the motor gone.

Sidewise balance requires most attention during a flight. As an airplane wing usually has a span of thirty feet or more, one tip frequently strikes *(Continued on page 156)*

HOW ERRORS CRASH PLANES

(Continued from page 155)

an up or down current which does not affect the other side and the plane is thrown off balance.

In the early Wright and Bleriot machines, sidewise balance was maintained by warping, or twisting, the wings. Now small auxiliary wings, or ailerons, hinged to the main supporting surfaces near the tips, are used for this purpose.

When the left wing drops, for example, the pilot swings his control stick over to the right. This causes the left aileron to drop and the right aileron to rise. The air currents striking the dropped aileron push up on the left wing and those striking the raised aileron push down on the right wing, thus restoring the plane to a level keel.

SEVERAL years ago, an Army pilot had an unusual experience with his ailerons while he was making some experimental flights to study the effect of sleet on his wings. He took off at Dayton, Ohio, and headed for Indianapolis. The sleet formed more thickly than he had expected. He decided to turn back.

In banking the plane, he moved his ailerons and the action caused some of the sleet that had lodged on the wings to slide down into the cracks in front of the ailerons. Here it froze, holding the ailerons in a grip that the pilot could not budge with his controls, swinging the plane about in a wide circle.

The pilot realized he couldn't straighten out until the frozen sleet thawed. And it was getting colder every minute. If he kept on, he knew he would circle until his gasoline gave out or the burden of sleet carried him down. So he picked out an open field, settled gradually and did a circular crash into the soft snow. One wing was wrecked but the pilot was unhurt.

According to the Department of Commerce statistics, "structural failure," that is, the actual breaking of wings or other parts of the planes, caused only 8.8 percent of the fatal crashes during the first half of last year. And a large share of these occurred because the pilot taxed his plane beyond the limits of safety, demanding the impossible of it.

Such was the case, a few months ago, with Roy Ahearn. In one year, Ahearn, as head of the Red Wing Flying Circus, carried 28,000 passengers without a single accident. He grew reckless, ignoring the danger of overstraining the ships he flew.

Near the Fokker factory, at Teterboro, N. J., last July, he climbed a little French Albert monoplane to 4,000 feet. He had told friends he would put the forty-horsepower "baby plane" into an outside loop. To withstand the terrific centrifugal force of the maneuver, he was tied in the cockpit with canvas bands as well as with a safety strap across his lap.

Four times the little engine failed to pull the machine through the vertical circle. The fifth time, Ahearn plunged into a terrific power dive, the throttle wide open. The nose of the plane passed the vertical line as he began the outside loop. Then spectators saw the wings tear off, flutter away like two blown newspapers, while the pilot, unable to tear himself loose from the canvas bands, rode the naked fuselage to his death.

Probably a greater strain is placed upon a plane by an outside loop than by any other aerial maneuver. The tops of the wings receive the terrific pressure instead of the bottoms, and the bracing which is designed to withstand the strains of landings has to support all the weight. The bracing wires between the wings of a biplane, for example, are divided into "flying wires" and "landing wires." The former angle down and in toward the fuselage; the latter down and out toward the wing tips. The flying wires resist the upward strain of the lift on the wings. The landing wires take the shock that comes to the wings when the machine lands heavily or "pancakes."

At Curtiss Field, Long Island, the other day, an advanced student attempted an outside loop in a light training biplane. The inevitable happened. He flew out of his wings and escaped death by a last-minute parachute jump.

When Adolphe Pegoud made the first upside down flight of history in 1913, he used a Bleriot monoplane that had won the Circuit of England race two years before. It was fitted with extra bracing wires on top of the wings. Now all planes are designed strongly enough for loops and ordinary stunts. Stunting is part of the tests through which a modern machine must pass before it is accepted. Present-day planes are stronger and safer than ever before. But all planes have limits which must be recognized. A pilot can "dive the wings off his ship" as surely as an automobile driver can skid into the ditch if he turns a sharp corner at high speed on a wet pavement.

Sudden or jerky movements of the controls have to be avoided. They mean excessive strains on the plane. However, there are times when too deliberate moving of the stick results in extra strain. For instance, in an ordinary loop if the pilot fails to pull the stick back sufficiently when the machine is upside down at the top of its vertical circle, he will make a wide arc in coming out of the evolution, picking up excess speed rapidly. Leveling off from such a dive places a tremendous strain upon the wings of the craft used.

The further and faster a dive is made the greater the strain. The fastest pursuit ships are designed to withstand a strain twelve times greater than that of normal, level flight.

LIEUT. James Doolittle, ace of Army stunt men, has come out of 250-mile-an-hour dives. In leveling off from such a dive, the wings of a 2,000-pound plane would have to support seven and a half tons without breaking, and a 180-pound pilot would be pressed into his seat as though he tipped the scales at approximately three quarters of a ton! Only a block and tackle could budge him out of it.

How terrific this pressure, and the resulting strain on the plane, must be, can be understood by recalling the way the slowing down of an elevator presses your feet against the floor. Yet, the descent of the fastest elevators in a New York City skyscraper never exceeds nine miles an hour, while Doolittle plunged at 250. That any plane can survive such a strain is a tribute to modern engineering skill.

In the early days of flying, pilots wore no parachutes, and bad crashes were always fatal. The dare-devils of the pre-war exhibition days, who flew to thrill the mob, took chances without understanding—or caring to understand—the strength or weakness of the planes they piloted.

From that type of reckless flying, the advance is being made to piloting that is based upon a clear conception of the capabilities and limitations of the craft being flown. The pilot of tomorrow will be trained to know his ship.

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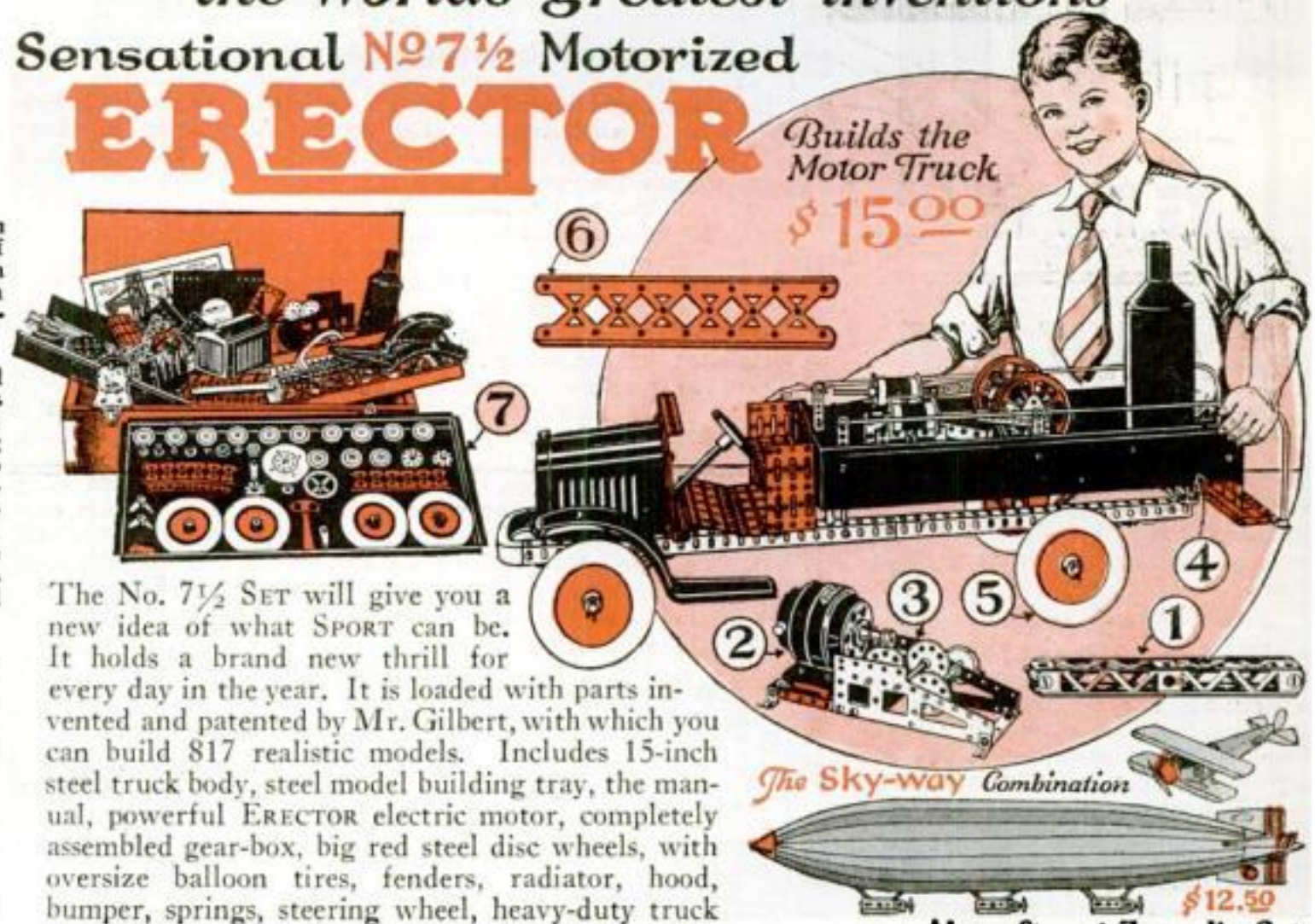

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BUILDS four-foot Zeppelin with landing mast, and nineteen different types of airplanes. Monoplanes, Biplanes, etc. Includes fuselage, wings, gondolas, silver Zeppelin bag, propellers—everything you need to build these realistic ships of the sky. Especially designed by Mr. Gilbert for boys who already have the Sensational No. 7½.

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HOW FIREBUGS BURN MILLIONS

(Continued from page 21)

Board operatives investigating the case.

They questioned the old man, who told them that, on awakening, he had detected a smell of chloroform in the room. A search of the ashes yielded bits of the soaked rag. From the lodging house superintendent they learned that his visitor had given a fictitious name and address.

Further investigation revealed that there was $12,000 worth of fire insurance on the house which, however, was so heavily mortgaged that little of it could have been collected by the owner. Then the recent $100,000 life insurance policy was turned up. The suspect's arrest and conviction followed.

HATRED, revenge, prejudice, and rivalry play smaller parts in incendiarism than mercenary motives; yet these passions cause thousands of dollars' worth of property to go up in flames each year. Every now and then the torch is applied in race riots and the burning down of churches.

But it is not only the infuriated mob that carries the torch. Vengeance-mad individuals swing it, too. A clear case of arson for revenge, for example, occurred in an Atlantic seaboard town the other day, when, in the absence of the chief of police, his $25,000 home was blown to fragments by rum runners whom he had driven out of town.

They literally drenched the place with gasoline, then set a time fuse. But the device was defective and ignited too soon. The firebugs barely escaped the terrific explosion, in which doors, windows, chunks of wall, and pieces of furniture were hurled hundreds of feet. Their own car was blown to bits. Even the license plates were burned. Only the letter representing the county still was visible. With this slender clue, detectives caught the criminals.

Comparatively easy to catch but hard to deal with from a legal standpoint is the pyromaniac. More or less insane, the "firebug" usually is pathetically childish and betrays himself by his tactics. Almost invariably, for example, he will remain at the scene of the fire he has set, or return if he has left, for his only reason for setting the blaze is to watch it. Thus investigators look for him, at a suspicious fire, among the throng of spectators. In this way, they have caught hundreds of pyromaniacs.

BESIDES, almost all firebugs have their own peculiar method. Some months ago, for instance, midwestern and Pennsylvania hotel keepers were alarmed by a series of fires that always started in laundry closets. National Board detectives observed that these blazes invariably occurred just after a certain traveling salesman had checked out of the hotel. About two dozen of such fires were traced to this man, an out-and-out pyromaniac.

An epidemic of tenement fires in New York City not long ago originated in baby carriages left in lower hallways. A dozen of these blazes were set by one man. Another dangerous pyromaniac had a predilection for filling fireless cookers with gasoline!

At present, the law does not differentiate between the pyromaniac and the fraud arsonist or the incendiary who, though sane, burns for some other reason. When an insane firebug is caught, he goes to jail. Experts, however, predict that some day when science has succeeded in penetrating the mysteries of this strange mental disease, special kinds of segregation and treatment will be devised for these dangerous unfortunates. That this is possible is indicated by the case of a firebug who has been restored to mental health by being assigned to stoke the prison furnace.

Thus far, scientific investigation has shed little light on pyromania. Psychologists believe that the firebug is a weak man who, by starting fires, convinces himself that he is not altogether without strength and importance. He sets a blaze. The house, the street, perhaps the whole town, are thrown into an uproar. The firebug, revelling in the excitement, says to himself: "Look what I did!"

One curious fact psychologists have discovered is that an amazing number of volunteer firemen really are sufferers from a mild form of pyromania. This is borne out by the experiences of National Board investigators and the police. In the words of Bielaski, it often happens that, when a small town gets a new piece of fire apparatus, a blaze follows almost immediately.

TO obtain as many arrests and convictions of firebugs as possible, the National Board, in the last three years, has been instrumental in the formation of special arson squads in 539 cities and towns in this country. The task of these squads, consisting of experienced members of the fire and police departments, is to ferret out evidence of arson in all suspicious fires.

In the past, such evidence often was destroyed by the firemen themselves, whose only ambition naturally is to extinguish a blaze quickly. Five investigators of the Board are continually engaged in teaching local firemen and policemen the fine points of this work.

Some months ago a college, devoted exclusively to the teaching of arson detection, was established in Los Angeles, Calif. All firemen are compelled to take the courses.

In New York City, Fire Marshal Thomas B. Brophy has reduced the business of catching firebugs to a science. The Bureau of Fire Investigation has a card index system containing the names of every person who ever has had a fire in New York. In another are registered the names of every known incendiary. A third lists every person who ever has been suspected of arson. A fourth contains the names and last known addresses of pyromaniacs.

A copy of this list is carried at all times by every member of Brophy's staff. When a suspicious fire is reported, it often happens that, by reference to this index, the Fire Marshal or one of his assistants discovers that a known firebug lives in the vicinity. An investigator goes to his home and checks his movements. Frequently, he makes an arrest before the fire has been put out.

LAST year, in New York City, 125 fires were reported as incendiary and 230 as suspicious. Arrests for arson totaled fifty-seven, an increase of twenty-six over the previous year. Twenty-nine incendiaries were put in jail.

In the past, the work of the National Board has been hampered seriously by the fact that the arson laws in the various states are conflicting and often ineffectual. Since 1920, the Board has succeeded in having twenty-seven states adopt a "model arson law."

While vigorous prosecution and uniform laws are indispensable in the fight on arson, popular education, in the opinion of Board officials, is the strongest weapon. Arson, they say, cannot be stamped out until the American people change their mental attitude towards it.

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